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New York State Museum

FREDERICK J. H. MERRILL Director

Bulletin 61

ECONOMIC GEOLOGY 11

QUARRIES OF BLUESTONE AND OTHER SANDSTONES IN THE UPPER DEVONIAN OF NEW YORK STATE

BUREAU OF AMERICAN ETHNOLOGY. Cancelled 1903 LIBRARY

BY

HAROLD T. DICKINSON

	PAGE
Preface	3
Introduction	4
Joints and bedding	7
Stripping	9
Quarrying	10
Dressing	12
Rent and ownership	13
Transportation	14
Market	16
Quarries in Greene and Ulster counties	17
Snake rock quarries	58
Merrihew ledge	64
List of buyers on Hudson river	65
Condition of the bluestone industry in Ulster county	67
Quarries in Broome, Delaware and Sullivan counties	67
Docks and stone buyers along Erie and Ontario and Western railroads	85
Quarries in the south central counties	86
Quarries in the southwestern counties	97
Index	105

Plates

1 Map of location of New York bluestone quarries	Cover page 3
2 Map of location of eastern Catskill bluestone quarries	Cover page 3

	FACE PAGE
3 Waste weir of Kingston reservoir no. 1, Sawkill valley, Ulster co	35
4 T. McDonald bluestone quarry in bed of Sawkill creek	36

Plates (*cont'd*)

	FACE PAGE
5 Tom Gad bluestone quarry on Jockey hill, Ulster co	37
6 Owen Grant bluestone quarry near Stony Hollow, Ulster co	38
7 Henry St John bluestone quarry, 1 mile east of Walton	69
8 Frank Bond bluestone quarry in Oxbow hollow, 3½ miles from Walton	69
9 George Davis bluestone quarry, 2½ miles east of Walton	69
10 J. Merritt bluestone quarry, 2 miles south of Hamden	70
11 I. J. Moore bluestone quarry, Pine creek south of Walton	71
12 W. G. Underwood bluestone quarry on N. Y. O. & W. R. R. between Cadosia and Rock Rift	71
13 Conrow and Hauyck bluestone quarry, north of Deposit	77
14 Bluestone quarry in Sands creek hollow near Hancock	83
15 F. G. Clarke bluestone co. quarry, Oxford	87
16 J. T. Hunt bluestone quarry, 6 miles north of Trumansburg	91
17 Genesee Valley bluestone co. quarry, 3 miles north of Portageville N. Y. on Pennsylvania R. R	93
18 Warsaw bluestone co. quarry at Rock Rift near Warsaw	94
19 Otis and Gage bluestone quarry at Rock Glen near Warsaw	95
20 F. F. Woodworth sandstone quarry at Cohocton	98

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Bulletin 61

ECONOMIC GEOLOGY 11

QUARRIES OF BLUESTONE AND OTHER SANDSTONES IN THE UPPER DEVONIAN OF NEW YORK STATE

PREFACE

The first official study of the building stones of New York was made by Dr James Hall, state geologist, in preparation for a report to the commissioners of the new state capitol in 1868. His examination of the building stones available for this great building led to the formation of a collection of large cubes dressed on different sides to show various modes of treatment, which is now the nucleus of a large collection in the Geological hall.

In 1886 Prof. John C. Smock took up the study of the building stones of New York and in bulletins 3 and 10 of the New York state museum, contributed copiously to our accurate knowledge of the resources of New York state in this sort of building material.

With the lapse of time it becomes necessary to enlarge our descriptions and records and it is now proposed to bring up to date our knowledge of the subject of building stones.

This has, however, grown to such an extent that it seems hopeless to treat it all in one volume or publication. It is intended, therefore, to issue, as time and means will permit, separate bulletins discussing various types of this important material. The first contribution is the following one on that valuable and important variety of sandstone known as bluestone and on rocks of allied character.

FREDERICK J. H. MERRILL

July 1902

The area in New York in which are quarried the sandstones of the Upper Devonian, as shown by the accompanying map, is bounded on the east by a line roughly parallel to the Hudson river and from 5 to 30 miles west of it, beginning in Albany county and running south to West Hurley in Ulster county, where it turns to the southwest, following Rondout creek. The northern boundary of these formations is approximately in an east and west line 15 to 20 miles south of the Mohawk valley and stretching westward to the shore of Lake Erie, which is the western limit. The whole of the central and southern part of New York state is occupied by these sedimentary rocks, the formations extending south into Pennsylvania. The sandstone is quarried at different localities throughout the whole territory, the most productive region being the southeastern part, where numerous quarries have been opened in the eastern face of the Catskill mountains, in the low lying terraces between the mountains and the Hudson river and in the hills on both sides of the Delaware river. This district is favorably situated for the transportation of the stone to the eastern markets and is the chief producer of the commercial "bluestone" so extensively used for flagstone, street crossings and house trimmings in the larger cities of the east.

The beds occur from the Hamilton group to and including the Catskill and are horizontal or dip at gentle angles. The greatest difference in elevation between the workable beds is shown in Ulster county, where a few of the mountain quarries are 2500 feet above the quarries nearest the Hudson river. The rocks are shales and sandstones. But there is so great a range in composition and texture that there are many varieties under each of these heads and an almost infinite gradation from one to another, and no sharp line can be drawn. The quarry stone is, as a rule, even bedded and compact and can be split in planes parallel to the bedding. In texture the stone

varies from the exceedingly fine grained material which takes a very even finish, to a sandstone which is almost conglomeritic in its nature. The color is highly variable, being blue, gray, greenish, pink and red in different localities.

Four geologic groups are represented in this territory, viz, Hamilton, Portage, Chemung and Catskill, but the distinctions between these groups are in part paleontologic and may be disregarded in a discussion of the economic geology of the area.

The main belt of country producing the even bedded and compact sandstone suitable for flagging and house trimmings known commercially as "bluestone" begins on the western side of the Hudson river in the southwestern part of Albany county and stretches southward through Greene, Ulster, Sullivan, Delaware and as far west as Broome county.

Besides this main belt there are scattered localities in the central part of the state, producing bluestone, at Oneonta, Rock Rift, Oxford, King's Ferry, Trumansburg and Portageville.

The district including Greene, Ulster, Delaware, Sullivan and Broome counties is the most productive, the products reaching the markets by the way of the Hudson river, and Erie and Ontario and Western railroads. The quarries in this district are all small and as a rule short lived.

The term bluestone was originally applied to the blue colored sandstone quarried in Ulster county, 4 to 7 miles west of the Hudson river. Today in commerce, the name bluestone is applied to a large part of the flagstone produced in the state, regardless of color. It is therefore, today rather a misnomer, for this material is sometimes green and occasionally reddish.

Probably 75% of the Ulster county stone is marketed in the condition known as "quarry dressed," the balance being treated in the mills along the Hudson river.

In Broome, Delaware and Sullivan counties a very small percentage of the product passes through mills in the district. Some "rock" however is shipped in the rough to other mills.

A large part of the stone at Oxford, Portageville and Rock Rift is subjected to mill treatment.

There are three classes of the product of the quarries, 1) flagstone, 2) "edge" stone and 3) "rock." The first class includes the stone used for sidewalks and requires little dressing. A stone 1½ inches thick and over, with a smooth surface and edges at right angles, fulfils all requirements. Bluestone is particularly suitable for use as flagging, retaining after long wear its rough surface. "The stone is so compact as to absorb but little moisture, and thus, when used as flagging, ice and rain remain upon it but a short time." "Its hardness resists wear, never forming the slipping surfaces of clay slate."

The second class includes such stone as curb, window and door sills, lintels and other house trimmings. This stone all requires dressing; curb requires "axing" on the face and edge. This class of stone requires one or more perfect edges for market.

The third class includes the stone sold in the rough to the dealers for mill treatment. All this is thick stone, varying from 4 inches to 5 and 6 feet. It is sawed or planed in the mills for platforms, steps and building stone.

The products of the first two classes are often treated in the mill when orders call for such finished work.

The kinds of stone as to shape, size and use are more numerous than the uninitiated would imagine.

As regards the microscopic structure and quality of the stone, the following notes by F. L. Nason[1] are interesting.

Bluestone. Bigelow bluestone co. (now Ulster bluestone co.) Minerals: quartz and feldspar. The quartz is in grains, which appear to be very angular in shape, more like a breccia. The grains are clearer than those of other sandstones examined, and the proportion of quartz grains to the rest of the matter is smaller. The feldspar observed differs very materially from that in the other stone. Grains of triclinic feldspar are observed, which are very fresh. Another feldspar is almost completely decomposed. No carbonate of lime appears to be present, and very little oxid of iron. The long, wavy, crystallike dark spots in the stone appear to be decomposed feld-

[1] N. Y. state mus. 47th an. rep't 1893. 1894. p.583; N. Y. state geol. 13th an. rep't 1893. 1894. p.389.

spar, more or less stained with iron. The cementing material is probably silica, as dilute hydrochloric acid has no effect, and it is not stained with iron.[1]

Joints and bedding

The beds of stone are divided naturally by vertical joints at right angles, one system running about north and south, while the other has an east and west direction. The north and south joints are known to the quarrymen as "side seams," while the east and west joints are called "heads," "head-offs" or "headers." These joints are persistent throughout the whole area of the two main districts, but in Delaware and Broome counties the east and west joints are likely to be very irregular. The distance between these joints determines the maximum size of the blocks, but not often is a stone the full size of the block taken up. These joints are from 5 feet to 75 feet apart as a rule. The bed is divided also by horizontal seams which are at varying distances apart. These layers are known as "lifts."

In addition to these open seams and between them, occur what are known as "reeds." The reeds are really closed seams which can be seen on looking closely at the edge of a block. The reeds are both an advantage and a disadvantage. They occur, as a rule, in only the fine grained stone. They are advantageous in that they provide means of splitting a thick stone into a number of thinner ones. This splitting is done by means of a "point" and thin wedges. They are a disadvantage in that they are a source of weakness in the stone. The frost will often open up the reeds, specially in curb which is set on edge. Each quarry has its characteristic reeds. A typical "black reed" is the best for splitting stone.

It is often true of these reeds that, after quarrying, when the stone is exposed to the weather two or three weeks before

[1]The test was as follows. A thin slice of the stone, $\frac{1}{100}$ of an inch thick was immersed in the dilute acid. In the case of a calcareous sandstone, or of a ferruginous sandstone, the grains of silica and feldspar would have been loosened into sand. The slice of rock remained practically unaffected.

frost, they tighten and close up, while, if it is quarried during the winter, the reeds will open. Again, it is true that, with a thick lift, if the stone is split to a thickness of 6 inches, there is no danger of the reeds opening, while, if it is left thicker than this, the danger of the reeds opening from exposure is great. Some reeds will not open at all, even when the block is "pointed" all around, and others will open only partly. As before stated, each quarry has its characteristic reeds, which have to be found by the quarrymen by experience.

The seams in the quarry are a source of trouble and at times loss. A seam will "shift and grow" or "double," that is, on the front edge of a block the thickness of a lift may be 2 inches while on the back the thickness will be 4 inches. Two seams have run together, not gradually, but by a sudden jump, leaving the two faces of the stone parallel. All these considerations affect the commercial value of a quarry.

When a quarry is first opened, the lifts are always thin, not over $\frac{3}{4}$ inch to 2 inches thick. As each tier of blocks is taken out, the lifts are thicker. Also it is a common occurrence to find that the lifts in the lower part of the bed are heavier than those at the top. All thin lifts are used as flagstone, while the thicker lifts are worked into edge stone or left in the rough and sold as "rock." As a rule, a good "rock" quarry is the most profitable, as the stone requires no dressing of any kind. But, on account of the sizes and weight of the stone, derricks are required.

Between the lifts, a thin bed of shale may occur, 3 to 4 inches thick. Shale is known to the quarrymen as "pencil." A "rough streak" in a quarry bed is a common occurrence. This is a streak of stone, of varying thickness, in which the seams are very irregular. There are varying degrees of "roughness"; part of the streak may be worked into salable stone, with extra labor, or it all may have to be dumped on the rubbish pile.

A bed of stone is said to be "bottomed" when a thick rough streak or pencil is encountered. A rough streak is not always permanent. With each new tier of blocks taken out, the con-

ditions change, and the rough streak may become as workable as the balance of the bed, and again it may increase in size, spoiling the bed entirely.

Nearly every quarry has its own peculiar formation. Quarries within 400 or 500 yards of each other frequently differ greatly as to quality and formation.

Stripping

The overburden, or "top," consists in Ulster county of a layer of soil, clay or hardpan, underneath this alternating beds of shale and rock. This "rock" is a name given to the part of the ledge which can not be worked into salable stone. ("Rock" also is a term applied to the thick "lifts" of stone which are sold to the mills for sawing and other treatment.) Below the shale and the rock is the bed of stone. The thickness of the soil, shale, rock and bed of stone is very variable. But a rough ratio for profitable quarrying is 1 of bed to from 2 to 3 of top, depending on the ease with which the stone is worked, its quality and the character of the bed. Some quarries have all soil top, some all rock, and again some have all shale top. Generally all three are found except in Delaware and Broome counties, where shale occurs rarely.

The stripping is usually carried on in winter, as only a few quarries can be worked when it is very cold, owing to the effect of freezing on the durability of the stone. The ground also is then frozen hard, and the scales of dirt are quite firmly cemented by frost. Dynamite or some other high explosive is used to loosen the rock and dirt. This is found to be better and more economical of time and labor, since the frozen dirt and slate can be handled better than when uncemented. The stripping is handled by shovels and wheelbarrows for the soil and shale, while powder and dynamite are employed in breaking up the rock. There is not much difference in cost of removing the various kinds of "top" except as to thickness. Rock is easily handled with a derrick after blasting. Hardpan requires considerable work even after blasting. Shale and soil require a great

deal of work in handling. A one horse dump cart or a small car and wooden or iron rails are often part of the equipment for stripping.

The waste material or rubbish is carted away and dumped opposite the face of the quarry. In the case of the quarries in the mountains, this rubbish is dumped down the mountain side. Very little attention has been paid to the proper disposal of this rubbish, for, in many cases, it has to be handled twice. In many beds which are now being worked in Ulster county the greatest part of the stripping is rubbish from quarries opened 40 years ago and abandoned.

Quarrying

Quarrying is carried on eight or nine months in the year. In many quarries no work at all is done during the winter. After the stripping is done, the different lifts are raised by wedges driven into the open seams, just enough to give the proper strain for the lift to free itself from the under bed. The area of these lifts varies with the size of the block. That of large ones may be 1000 square feet or more. The thickness varies from 1 inch to 8 feet.

If it is not possible to lift the layer from the whole block, a line is marked by cord and chalk where it is necessary to break the stone. This line is traced across with a point by digging out holes $\frac{3}{4}$ inch to 1 inch deep and from 2 inches to 3 inches apart. The point is held so that its horizontal projection will fall along the chalk line. After the block has been traced across, every sixth or seventh hole is drilled to a depth corresponding to the thickness of the lift. In these deeper holes, plugs and feathers are placed. The plugs are driven down together by striking one after another, so that the strain is equal all along the line. To do this well requires a great deal of skill, which is a result of long and close attention to work. At a certain point of strain the stone will break off along the chalk line, true and even. In Ulster county the stone breaks the best in a north and south

line following the side seam, while in Delaware and Broome counties the stone breaks best in an east and west direction. The quarrymen say that the stone "works" best north and south or east and west as the case may be. This same system is used in breaking lifts of large area to smaller sizes.

Generally, very little powder is used in blasting out the bed of the stone. The joints are usually free or open for working. When powder is necessary in the bed the "Knox" system of blasting is used, a short description of which follows. The holes are first drilled to the desired depth in a line then "reamed" out, making the hole elliptic in section, the longer axis being in the line of the holes. A small amount of explosive is put in each hole with little or no tamping. Within a foot or so of the top of the hole a plug is put in and the tamping placed on top of this. The holes are fired simultaneously by electricity. The greater part of the force of the explosion is taken up by the air cushion and, as a result, the block is not shattered or split.

In the larger quarries in Ulster county district, hand and horse power derricks are used, but in no case are there any steam hoists except at the docks. In Delaware and Broome counties there are a few steam derricks, and all the larger quarries are equipped with hand or horse power derricks. A blacksmith shop for sharpening and tempering tools is usually part of the equipment of all the quarries. The tools consist of hammers, points, drills, wedges, plugs and feathers, crowbars and shovels. In a very few instances does the equipment include steam drills or pumps.

When water is troublesome a siphon is used, if a sufficient fall can be had, or a horse or hand power pump is used when a siphon is not available. In the few cases in which the steam pump is used the "pulsometer" seems to be a favorite.

The following from *Stone* is of interest as showing the peculiarities of bluestone quarrying:

The quarrying of bluestone probably requires as much skill, if not more, than any other kind of stone, a fact often over-

looked and a potent factor in the success of a quarryman. It seems to be a general impression among a great many users and perhaps a few of the producers of this most useful and durable stone, that a man needs only to find a deposit of salable quality of bluestone, no more than usual proportion of top to bed, with the usual shipping facilities, and success is assured. But for any one who has been closely connected with this especially interesting business, it is easy to find the reason why a quarry has not paid. The causes are usually radical, and one of the first flaws after ascertaining that the quarry contains stone in fair quantity will be found by looking into the system of quarrying, and here is frequently a drawback to the prosperity of the quarry.

As a rule, the best quarrymen have worked in the quarries from the time they have been able to do anything, and, as that is usually pretty early in life, many of them have gained such knowledge of the work that they know to a certainty how the stone will work, as soon as they see the bed, without raising a lift. It is only after long work that a quarryman becomes expert.

Dressing

After the stone is lifted from the bed, it is handed over to the stonecutter, who prepares it for market. If it is flagstone, it is cut into commercial sizes 2, 3 or 4 feet wide, and the irregularities are chiseled down. Flag, as a rule, requires little dressing. If the stone is to be cut into curb or other "edge" stone, the block must be split, if too thick, and then broken to the proper width. Curb is usually "axed" 12 inches to 14 inches on the face, and the top edge is pitched at the proper angle. "Rock" and platform require no dressing in the quarry. The dressing of the stone in the quarry is usually of the roughest kind and is done as quickly as possible. For the finer grades of axed and cut stone, the work is done on the docks.

At many of the docks stone mills are in operation. The mill treatment consists of sawing large blocks, planing and rubbing the house trimmings, platforms, steps etc., and boring sewer heads.

There is a great difference in the stone in regard to its action under a saw or planer. Some stone will chip or check under a planer and not give the smooth surface desired, while other

stone will wear out the gang saws very fast. The action of a stone in a mill depends largely on its hardness and texture.

A planer consists of a stationary base with a moving carriage, on which the stone is placed and held firmly by set screws. This carriage moves forward and backward under the bits of the planer. These bits are fastened to the immovable part of the frame, and, as the stone passes under them, take off the irregularities of the surface.

A gang saw has a varying number of saws set at different or the same distances apart. These saws are fastened by wedges on a frame above the block of stone and are moved forward and back by an eccentric. As the cuts in the stone deepen, the frame is lowered by a feeding device. Sand and water are fed into the cuts during the sawing.

Rubbing is usually a secondary treatment to planing. The rubbing bed is a circular cast-iron plate, which revolves horizontally. The stone is placed on this and held stationary by projecting arms. The revolving cast-iron plate grinds the stone and smooths off the irregularities of planing. Sand and water are fed from the center into the bed during the process.

Another kind of saw is the "diamond" saw, which has diamonds set along the edge of the saw. The diamonds are held in cast-iron teeth, which are removable from the blade. There are 10 to 12 teeth, containing 2 to 3 "borts," in each saw, spaced equally, according to length of blade. The diamond saws cut 23″ to 24″ an hour, while the ordinary gang saw cuts only $2\frac{1}{2}$″ to $2\frac{3}{4}$″ an hour.

Most docks have one or more stonecutters employed in special and fine work.

Rent and ownership

The majority of the quarries in the two main districts are worked by two or three men, sometimes in partnership, but often one man operates the quarry, hiring one or two extra men as quarrymen or stonecutters. A good stonecutter can command a wage of $1.75 to $2.25 a day, while a quarryman is paid $1.50 to $2, and in some places only $1 a day. In Delaware and

Broome counties the demand for stonecutters is greater than the supply this year.

The quarrymen seldom own the land on which the quarry is situated, but lease it at a rental proportionate to the amount of stone taken out. In Ulster county the usual rental is 5% of the value of the stone quarried. In Delaware and Broome counties the rental varies from ½c to 1c a foot of the product, according to the location of the quarry. This "per foot" applies to the stone as sold, that is, if the stone is sold per linear foot, the rental is ½c per linear foot; if sold per square foot, the rental is ½c per square foot. This is hard on the flagstone quarries, as the price of flag ranges from 5c to 8c a square foot, but for quarries producing edge stone, the rental is much less, as curb is sold for 16c a foot. The charge of 5% appears to be a much fairer way of renting.

In Ulster county the larger quarries are in many cases owned by the dealers, but in only a few cases are the dealers operating the quarries. They prefer to rent them on a percentage basis. They own the ledges in order to control the output of the stone.

Transportation

The stone is hauled by two, three and four horse teams to the docks or railroad switches. Only at Rock Rift and Portageville do the railroad switches run into the quarries. In Ulster county very little stone is shipped by way of the Ulster and Delaware railroad from Broadhead's Bridge to Kingston. The freight rate is higher than the cost by wagon.

The wagons in use hold from 8 to 10 tons of rock. A great proportion of these wagons are now equipped with wide tires; in fact, some towns have local legislation requiring wide tires on wagons weighing over a certain amount. The main quarry roads are often "bridged" with bluestone. "Bridging" consists of thick stone laid as a track for the wheels of a wagon. This "bridge" is 20 inches wide and 4 inches to 6 inches thick. It does not take long for wagons to wear deep ruts in the bridge.

But, if kept in repair, these bridge roads are the best for the heavy quarry wagons. The quarries on the hills and mountains have a separate road leading to each from the main roads. As a rule, these are in fearful condition, being cut to pieces by the chained wheels. The grade of these roads is very steep. A 25% grade is not an uncommon one. An extra horse is often employed for hauling the stone wagons up to the quarry.

The loading of the stone on the wagons in the quarry is done by a derrick when possible. If there is no derrick in the quarry, the loading is done by hand. If there are a number of quarries near together, the different gangs assist one another in loading.

In coming down loaded, one or both of the rear wheels are chained or a shoe is used. In addition to this, the front wheels are equipped with foot brakes. The driving of these wagons down such steep grades is attended with much danger, and many fatal accidents occur. The drivers become very skilful in the work, but at times are careless. Carelessness in chaining wheels is often the cause of the most serious accidents. After the wagons reach the main roads, few steep grades are met. The unloading of the stone at the docks or switches is done usually with hand, horse or steam power derricks. The different sizes are piled at separate points on the docks and shipped as ordered.

The cost of transportation to the docks or shipping points is borne by the quarrymen. The cost is based on the value of the load, the distance between the quarry and the dock and the condition and grade of road. The cost runs as high as 50% of the value of the load and as low as from 8 to 10%. The latter cost is for quarries favorably situated in respect to the docks. Usually a team will make three and four trips a day between the dock and quarry, at this price. Quarries are often spoken of as "three trip" or "four trip" quarries, as the case may be. Only the larger quarries have their own teams, and the hauling is often conducted as a separate business from the quarrying of the stone.

Market

The stone from the quarries is sold to the wholesale dealers, who make a business of collecting the stone and shipping it to the place of consumption. The stone is paid for by the load, or each week or month. Usually the cartage is deducted and paid directly to the teamster. Rent also is deducted from the value of each load, if the dealer owns the quarry ledge.

The stone is sold by the square and linear foot. Flagstone is always sold by the square foot, while curb and crosswalks are sold by the linear foot. What is known as "rock" (the thick large stone) is sold at so much an inch per square foot. That is, a stone 10 inches thick, 10 feet square at 2½c an inch, would sell for $25.

At one time there was a combination of the dealers along the Hudson river to control prices; but this has been broken up now, and the competition between the buyers has resulted in a rise of prices paid to the quarrymen. The largest dealers along the Hudson river have New York or Philadelphia offices, which are selling agencies. Along the Erie and Ontario and Western railroad a few dealers combine and pay an equal share of the expense of a selling agency in one of the large cities. The stone from the Hudson river is sold mostly in New York and New England cities and villages. This stone is loaded on barges, which are towed to the different cities on the seacoast. The stone from Delaware and Broome counties is sold very little in New York city, the high cost of freight and lighterage prohibiting competition with Ulster county stone. This stone is sold in New York and inland towns, such as Binghamton, Elmira, Rochester, Johnstown, Syracuse, Utica. Some of the stone from this district goes to Philadelphia.

The time available for this investigation did not permit the author to visit the quarries of Albany county, consequently the quarry descriptions are not complete for the entire state. For Albany county see Nason, N. Y. state mus. 47th an. rep't, p. 457.

QUARRIES IN GREENE AND ULSTER COUNTIES

The main points where bluestone is quarried in these counties are Quarryville, Fish Creek, Highwoods, Dutch Settlement, Palenville, West Saugerties, Woodstock, Jockey hill, West Hurley, Stony Hollow, Lapala and Mackey hill.

Beginning on the north in Greene county and following a line roughly parallel to the Hudson, the first quarries in this district are 4 miles west of Catskill, those of Lane Bros., Lane & Bloom, Lane & Hood, and Herbert Bloom.

Lane Bros. Bed of stone is 7½ feet thick, with 20 feet of rock and slate stripping. Stone is fine grained, very reedy and of good blue color. The bed is rough and dips south and west. Cross bedding is shown and some "rock" is interbedded with the stone. Lifts are 3″ to 12″ thick. Three to four men are employed nine months in the year. Product is principally curb and other edge stone, and is sold to Smith & Yeager at Catskill.

Herbert Bloom. Quarry is south of Lane Bros. and on same ledge, working only top bed of thin bedded flag 3 feet thick. One man is employed intermittently. The product is flag, and is sold to Smith & Yeager at Catskill.

William Lane & L. Hood. These work on this same ledge occasionally, and sell the product at Catskill to Smith & Yeager.

James Lane & Jacob Bloom. This quarry is situated a quarter of a mile north of Lane Bros., and is probably on the same ledge. Bed of stone is 8 to 9 feet thick, with a top of 15 feet of rock, in which shaly streaks occur. The stone is of fair quality, fine grained and of good blue color. The bed dips slightly to the south and west. Two men are employed during summer months. Product is mostly edge stone, which is sold to Smith & Yeager at Catskill.

To the south of the above are the quarries near Kiskatom and High Falls, where six openings are being worked, as follows.

Bean & Lewis, Kiskatom. Quarry is situated ¾ mile south of Kiskatom. Bed of stone is 5 feet thick with 12 to 15 feet of clay top. Stone is fine grained and full of reeds, and of very dark blue color. No danger of reeds opening when stone is split to

10″ thick. Lifts vary from 10″ to 24″ in thickness. This stone does not work well under planer, being very tough. No "head-offs" are seen in the opening. Product is mostly edge stone, which is hauled 7 miles to Malden and sold to Ulster bluestone co. Cost of cartage is 26% of value of load. Four to five men are employed during the summer months.

Dederick Bros., Kiskatom. This is a small quarry situated east of Bean & Lewis and on the ledge below their quarry. Bed of stone is 2½ feet thick with 7 to 8 feet of clay top. When this quarry was first opened, the bed was much thicker, but, as the quarrymen say, it has "pitched out." Stone is of medium sized grains and good blue color. Reeds are present but are said not to open from the weather. No head-offs are to be seen. Bed dips to the south and west. The ledge has been opened up 300 to 400 feet in a north and south direction. Lifts vary from 2″ to 10″. Product is flag and edge stone, which is sold to Smith & Yeager at West Camp. Three men are employed all the year.

Smith & Yeager, Kiskatom. Quarry is just east of Dederick Bros. and on ledge below. Bed of stone averages 10 feet in thickness with a top of 3 feet of rock, and 12 to 15 feet of clay. The stone is rather fine grained and quite dark blue. Reeds are present, and stone is split 10″ or 12″ to avoid danger of their opening. Lifts are heavy, 5 to 6 feet thick. Water is troublesome here and is handled by a "Bush" pump. The quarry is equipped with two horse power derricks and a steam drill. As no "heads" are present, the drill is used to break off blocks. The holes are drilled very close together in an east and west line. The distance between the edges of adjoining holes is about 1½″. After a row of holes has been drilled the width of the block, a new bit is set in the drill, which breaks out the connecting stone between two holes, giving a fluted appearance to the edge of each block. This is the only place in the Ulster county district where this system is used. The product is of all classes of stone, which is hauled to West Camp. This firm is a small buyer of stone from this district and has docks at Catskill and West

Camp (Smiths Landing). It employs six to eight men in the quarry the year round.

Dederick & Frieze, Kiskatom. Quarry is ¼ mile north of Smith & Yeager and on the same ledge. Bed of stone is 7 feet thick, with 8 to 10 feet of top, 3 feet being rock, the balance clay. Stone is of medium grain and very "reedy." The reeds are very likely to open on exposure. Bed dips to the south and west. Two to three men are employed the year round. Product is mostly edge stone, which is hauled to Malden and sold to the Ulster bluestone co.

Near this quarry are a number of abandoned openings which have not been worked in several years.

James Sterrett, Saxton. Quarry is situated ½ mile west of High Falls. Bed of stone is 13 feet thick, with 35 to 40 feet of alternating beds of rock and shale top. 22 feet above the top of the stone bed a lift of rather coarse grained gray sandstone occurs 2 feet thick, some of which is sold. This stratum occurs 2 miles south of this quarry in the Michigan quarries. Stone is fine grained and a good blue in color. There are no open seams in the bed. The stone is split along the reeds. The quarry is equipped with horse power derrick and siphon. No head-offs appear, but the side seams are very regular. Product is mostly edge stone, which is sold to the Ulster bluestone co. at Malden. Three or four men employed during the summer months.

Harvey Myers, Ashbury, and **Owen Devery**, Quarryville. Both work small quarries occasionally in the vicinity of High Falls.

Farther south at Quarryville is one of the most productive points of the whole Ulster county district.

Abraham Miller & Co., Quarryville. The first quarry south of Sterrett's. Quarry is situated 1 mile north of Quarryville. The bed of stone is 6 feet thick, with top of 20 to 25 feet consisting of rock and black shale. The stone is fine grained, of good blue color and quite reedy. As the lifts vary from 5″ to 6″, there is no danger of the stone "reeding" open. Few heads are present. The strata worked dip to the south and west. The

quarry is equipped with hand derrick and siphon. Three men are employed throughout the year. The product is chiefly flagstone, which is sold to the Ulster bluestone co. at Malden.

Con Harvey, Quarryville. This quarry is south of the preceding. The bed of stone is 10 feet thick, with an overburden of 20 to 30 feet, 15 feet of which is rock, the balance clay. The stone is of the best blue color, fine grained and full of reeds, which will not weather open if stone is split to 20″ to 24″ thickness. No heads are found in this quarry, but the side seams are very regular, 3 to 9 feet apart.

The top part of this bed is grayer and harder than the lower lifts, which are soft and blue. All the stone, however, works well in the mill. The product is almost entirely "rock." Four to five men are employed all the year. The equipment consists of a steam pump to handle the rain water, and that issuing from springs in the quarry. Some very large stones have been taken from the quarry, one slab being 9 inches thick and 17 feet by 16 feet in area.

Alfonso Carnright, Quarryville. This quarry is on the same ledge as Harvey's and just south of it. The bed of stone is the same, but the top is 35 feet thick. The gray sandstone noted under Sterrett's quarry shows here in the top. These two quarries are known as the "Michigan" quarries. The ledge is owned by the Ulster bluestone co. of Malden, which buys all the stone. There is only one lift in the bed, but the reeds are so frequent that the stone is easily split.

These quarries were very valuable at one time and have produced a large amount of stone, but now the top is very heavy for the bed, and only skilful quarrying makes it possible to operate them profitably.

The rock is hauled 4 miles to Malden at a cost of 20% of the value of each load. The prices paid vary from 3c to 5c an inch of thickness per square foot. Carnright employs four or five men throughout the year.

South of and below the Michigan ledge is the Quarryville ledge, which has been opened for over a mile in a north and south direction. This was the great ledge of the district at one

time, 350 to 400 men being employed at different points. The whole ledge is owned by the Ulster bluestone co. at Malden, to which all the stone is sold. The lifts are very thick, and the chief product is rock and edge stone. The dip of the bed is to the south and west. The water from springs and rains is concentrated at the lower end of the opening, where it is handled by steam pumps installed and operated by the Ulster bluestone co. Each quarryman is charged 5% of the value of the stone quarried, in addition to the rental, for the operation of these pumps.

The bed of stone is fine grained and of good blue color, and reedy. The top lifts are grayer and harder than the bottom lifts. The bed averages 13 to 14 feet thick, 8 feet of which are really good workable stone. The top consists of clay rock and shale of varying thickness, the average being 20 feet. The lifts vary from 6 inches to 6 feet in thickness. The top lifts are worked into edge stone, the lower lifts being sold as rock.

Each firm has either a hand or horse power derrick. Some of the derricks are not owned by the firms, who pay a rental for their use of 5% of the value of the stone produced. 18% of the load value is charged for cartage to Malden.

The different firms working the ledge from north to south and the men employed are given. All are of Quarryville.

Rightmeyer, Bovee & Craft. Three men the year round.

K. Foley. Four men 10 months in the year.

John O'Rourke. Four men nine months in the year.

Hollenbeck & Miller. Four men in summer and two men in winter.

Mack & Kraft. Four men in summer and two men in winter.

C. E. Cook. Three to four men nine months in the year.

Cook & Schoonmaker. Four to five men nine months in the year.

Just east of the main Quarryville ledge and below it another ledge has been opened.

Michael O'Rourke, Quarryville. This is the first ledge west of the Hudson river that has been opened. The bed of stone is 7 feet thick, with 2 feet of rock, 7½ feet of shale and 2 to 3 feet of

clay top. Stone is of fairly good blue color, fine grained and reedy. The lifts vary from 2 to 3 feet, and are split to 6″ or 7″ for safety. Three to four men are employed steadily. The ledge is owned by Joseph Maxwell of Saugerties, to whom the stone is sold. The product is chiefly curb and flagstone. The quarry is equipped with a hand pump for disposing of water.

Just above the west of the main ledge at Quarryville two other ledges have been opened.

Van Steenburg & O'Connor, Quarryville, are working the first ledge above. The bed is 6 to 7 feet thick, with 15 to 20 feet of rock top. The quarry is an old one and is badly blocked up with rubbish. The stone is of fair quality and color. The quarry is equipped with hand derrick. Two men are employed part of the year.

Cunningham & Schoonmaker, Quarryville, are working on the next ledge above. The bed, which is a mixture of rock and stone (the larger portion being rock) is 12 feet thick and has a top of 5 feet of rock and clay. The stone is much darker blue than that from the main ledge, and of finer grain. The lifts vary from 2″ to 4″. The product, entirely flag, is sold to T. J. Dunn & Co. at Malden. Two men are employed. The quarry is equipped with hand derrick and siphon.

Between Quarryville and Veteran postoffice there are a few small quarries.

Lawrence Hummel, Quarryville. Quarry is situated ½ mile west of Mt Airy. The bed of stone is 4 to 5 feet thick, with 8 to 10 feet of top of rock and clay. The stone is of medium grain and very dark blue color, and quite reedy. The lifts vary from 6″ to 8″ in thickness. The bed dips more sharply than usual to the west and south. Product is chiefly flag, which is sold to T. J. Dunn & Co. at Malden.

Carty & Rourke, Veteran postoffice. Quarry situated ¾ mile north of Veteran or Unionville. The bed of stone is 7 to 8 feet thick, with 8 to 10 feet of clay and rubbish top. The stone is of a good blue and varies in grain from top to bottom. The top lifts are of coarser grain, and harder than the bottom lifts. A

rough streak 1 to 2 feet thick occurs in the center of the bed. The stone is reedy and is split to 10″ to 16″ for safety. No head-offs are to be seen, but the side seams are straight and regular 3 to 9 feet apart. The product is principally edge stone, which is sold to Hudson river bluestone co. at Saugerties. The quarry is equipped with horse power derrick and siphon. Three to four men are employed all the year.

Brink & Jones, Veteran postoffice. A very small and poor quarry on ledge above Carty & Rourke's. The bed is very rough and 3 to 4 feet thick. The stone is fine grained and good blue in color. Two men are employed, not regularly.

Martin Dunn, Veteran postoffice. This is an old quarry on ledge above Carty & Rourke's and is badly blocked up with rubbish. The bed of stone is very rough and 5 to 6 feet thick, with 7 to 8 feet of rock top. It is fine grained and of good blue color. The lifts are 6″ to 8″ thick. The product is sold to James Maxwell at Saugerties. Two men employed, intermittently.

From Veteran postoffice south through Fish Creek and Highwoods is another very productive territory. But the industry has decreased in late years, specially at Fish Creek, where the surrounding hills are covered with old rubbish heaps. At Veteran postoffice there are numerous openings, but only a few quarries are being worked now.

Wyman Spring & Flynn, Veteran postoffice. Quarry situated ½ mile west of Veteran postoffice. The bed of stone is 4 to 5 feet thick, with top of 10 to 12 feet of rock. The bed dips more sharply than usual to the south and west. The stone is fine grained, of good blue color, and some reeds are present. The side seams and heads are quite regular. Streaks of shale appear in the bed. Three men are employed throughout the year. The product is sold to the Ulster bluestone co. at Malden.

Flanagan & Connors, Veteran postoffice. This firm is working on the same ledge as Wyman & Co., and just east of them. The bed is only 2½ feet thick, with the same amount of top. The dip is in the same direction as that in the preceding quarry, though more gentle. The stone is of a lighter shade of blue. Two men

are employed throughout the year. The product is sold to James Maxwell at Saugerties.

Along the road from Veteran postoffice, running south through Fish Creek and Highwoods are numerous quarries. Just south of Veteran is the following quarry.

William Hayen, Veteran postoffice. The bed of stone is 10 to 12 feet thick, with 10 to 12 feet of top, which is mostly shale. Bed dips as usual to the south and west, and the bedding planes are irregular. The stone is fine grained, of good blue color and reedy. The rifts vary from 20″ to 24″, which are split into curb. Two men are employed throughout the year. The product is sold to James Maxwell at Saugerties, who owns the ledge.

Eygo Bros. & Cronin, Veteran postoffice. This firm works on same ledge as Hayen. This ledge has been opened about ¼ mile in a north and south direction. Three men employed throughout the year.

John Ferguson, Veteran postoffice. This quarry is just east of Hayen's and on the ledge above. It is being worked toward the east and against the dip. This is unusual, nearly all the quarries being worked from the east toward the west. The bed of stone is 5 to 6 feet thick, with 10 feet of shale top. The stone is fine grained, of good blue color and reedy. The lifts vary from 24″ to 30″. The head-offs are not very prominent and the side seams are somewhat irregular. The product is principally curb, which is sold to James Maxwell at Saugerties, who owns the ledge. Three to four men are employed during the year. This ledge has been extensively worked, but the top is becoming too heavy for the bed.

John Cusick, Veteran postoffice. Quarry is on same ledge as Ferguson, but just north. The top is somewhat thicker, being nearly 60 feet of shale. There is a curious streak in the shale, in which large round boulders are bedded. Two to three men are employed.

Brennan Bros. & Ledwith, Veteran postoffice. This quarry is situated ¾ mile south of Veteran and is in the vicinity of

numerous abandoned openings. The bed of stone is 4 to 5 feet thick, with a rock top of 10 to 12 feet. The stone is of medium grain, good color and some reeds are present. The lifts vary from 5″ to 8″ in thickness. The bed dips more sharply than usual to the southwest. The product is principally curb, which is sold to the Ulster bluestone co. Three men are employed throughout the year.

Daniel J. Burke, Veteran postoffice. Quarry situated south of Brennan's. The bed of stone is 4 feet thick, with 5 to 6 feet of rock top. The stone is of fair blue color, fine grained and somewhat harder than is usual in this vicinity. The quarry is said to work "hard." The side seams are very regular and the joints are loose. Lifts vary from 4″ to 20″. The product is edge stone, which is sold to the Hudson river bluestone co. at Saugerties. Four to five men are employed throughout the year. The cost of cartage in this vicinity is based on the number of feet of stone in each load.

T. H. Lockwood, Saugerties. The quarry is situated just north of Fish Creek. The bed of stone is 11 feet thick, with a top of 10 to 15 feet. The stone is of good blue color, fine grained and reedy. The lifts vary from 6″ to 10″, and are split into curb, the principal product. The bed dips south and west. Some blasting is done in the quarry bed, as the heads are absent. The side seams are quite regular and tight. Quarry is equipped with hand derrick. Four to five men are employed during the year. The product is sold to James Maxwell at Saugerties.

Southeast of Fish Creek on Cockburn hill a number of quarries are in operation. One long ledge has been opened on the southern side of the hill, and with two exceptions all the firms are quarrying on this ledge. The ledge has the usual south and west dip, so the drainage is natural toward the lowest and western quarry. The bed of stone averages 7 feet in thickness, is fine grained, of good blue color and quite reedy. Where the ledge has been worked back any great distance, the lifts are heavy, but are easily split along the reeds. Heads are not present as a rule, but the side seams are quite regular.

The ledges are owned by James Maxwell of Saugerties, who buys the output. The top lifts are usually harder than the lower ones.

The following are the operators.

Daniel Darrigan, Saugerties. Bed of stone is 4 to 5 feet thick, with 12 to 15 feet of rock top. Bed dips to the south and west gently. Stone is of medium grain, good blue color, but very reedy. The lifts vary from 4″ to 8″ in thickness. Both systems of vertical joints are present. The product includes all varieties of marketable stone. Five to six men are employed.

Lahert Bros., Highwoods. Bed of stone 6 feet thick, with 9 feet of top, 1 foot of which is rock, the balance being clay containing boulders. Stone is light blue, fine grained and reedy. Lifts are quite heavy, being as thick as 4 feet. Bed dips gently to the southwest. The product is mainly curb. Four men are employed during the year.

Daniel Darrigan, Veteran. Quarry on the same ledge as that of Lahert Bros. One man employed during the year.

Mrs John Darrigan, Highwoods. The bed of stone here is 8 feet thick, with 20 feet of clay and rock top. The stone is a darker shade of blue than that in Laherts' opening. A shale streak also appears in the bed here. The product includes all varieties. Four to five men are employed during the year. The quarry is equipped with a hand derrick.

Richard Lannigan, Highwoods. The bed is the same in thickness and quality of stone as at Darrigan's, but the top is somewhat different, consisting of 3 to 4 feet of clay, 4 feet of shale and 3 feet of rock. The top lifts of this bed are hard, while the lower lifts are softer. No heads are present. The product is chiefly edge stone. Four men are employed throughout the year. A hand derrick is in use.

William Scott, Highwoods. The bed here is not quite so thick, about 7 feet, with 10 or 12 feet of top, mostly shale. The quality of stone is the same. Four men are employed during the year.

James Darrigan, Veteran postoffice. Three men are employed at this quarry, which is close to Scott's, and resembles that quarry in the quality of bed and thickness.

Whittaker & Manterstuck, Veteran postoffice. This is on the same ledge as the preceding, but on the northern side of the hill. The bed is 7 to 8 feet thick, with only a clay top of 3 feet. The quality of stone is the same as in the other quarries. On account of the dip and the direction of working, water is somewhat troublesome. The lifts are 8″ to 10″ thick.

On ledges above the main ledge are numerous abandoned workings, a few of which are being reopened.

John Skchill, Veteran postoffice. The bed of stone is 4 to 5 feet thick, with 10 feet of rock and clay top. A shaly streak is present in the bed. Only one man is employed, eight months in the year.

Lasher Bros., Veteran postoffice. This quarry is on a ledge higher than Skchill's and was abandoned at one time. The bed is 4 feet thick, with 20 feet of rock top. The stone is of good blue color, fine grained and reedy. Heads and side seams are present, and the dip is to the south and west. Two men are employed.

South of Cockburn hill is the Highwoods district. Three different ledges are being worked. On the lowest and most eastern seven firms are quarrying. All the ledges are being worked to the west with the dip. On account of this, water is troublesome in places. The bed of stone averages 12 feet in thickness. The bedding is rather uneven in spots, which causes a great deal of waste. The stone is fine grained, of good blue color and reedy throughout the ledge. The ledge has been worked for a number of years, and the lifts are heavy as a rule. The side seams are quite regular and smooth, but the heads are few and far apart. The top is chiefly shale or pencil. Some shaly streaks appear in the bed. The dip is to the south and west. Blasting is sometimes necessary in getting out the stone.

The following are the operators.

Vedder & Hackett, Highwoods. The bed here is rough and several pencil or shale streaks appear. Four men are employed. The equipment consists of a steam boiler, pulsometer pump and horse power derrick. The product is sold to the Ulster bluestone co. at Glasco.

Richard Rind, Highwoods. Works intermittently, just south of Vedder & Hackett.

Kelly & Hackett, Highwoods. The bed here is 12 feet thick, with 10 feet of shale and clay top. The top 3 feet of bed are hard, while the bottom 9 feet are softer, but do not split so well. The product is mainly curb, which is sold to James Maxwell at Glasco. Four men are employed. The equipment consists of steam boiler, centrifugal pump and steam drill, which has not been used in the quarry as yet.

Thomas Rafferty, Highwoods. The bed is rather rough here. Two men are employed during the year. Edge stone forms the product, which is sold to James Maxwell at Glasco.

Riley Bros., Cockburn. Only 4 feet of the bed are being worked here, owing to rough streaks in lower lifts. The shale top is 15 feet thick. The product is chiefly curb, which is hauled to Glasco and sold to James Maxwell.

William Lannigan, Highwoods. The bed is 14 feet thick, with 12 to 25 feet of shale top. The lifts vary from 14 inches to 4 feet. The product is sold to T. J. Dunn & Co. at Malden. Eight to nine men are employed throughout the year. The quarry is equipped with horse power derrick and pump.

Daniel Rafferty, Cockburn. Works on this same ledge intermittently.

Two quarries are worked on the ledge to the west and the above described ledge. The bed is 11 feet thick, with the shale top 15 to 20 feet thick. Rough streaks occur in the bed occasionally. The stone is fine grained, reedy and of a good blue color, and is easily worked. The lifts vary from 6 inches to 3 feet. The side seams are smooth and regular, 3 to 10 feet apart. Water is troublesome in a wet season. The product from the two quarries is chiefly curbstone and is sold to Thomas J. Dunn & Co. at Malden. The following are the operators.

Lawrence Kenney, Kingston. Employs eight to nine men throughout the year. The equipment of the quarry consists of horse power derrick and pump.

Levi Carle, Cockburn. Two men are employed during the year. A hand derrick is the equipment.

The next ledge to the west is known as "High bank." Only four quarries are in active operation, though this ledge and the one below it have been extensively opened for some distance. The bed of stone averages 6 feet thick, with various thicknesses and kinds of top. The stone is fine grained, of dark blue color, and with numerous reeds. Side seams and heads are both present at varying distances apart. The dip of the bed is the same as that of the other ledges south and west. The bed has rough streaks through it and cross bedding is seen. Stone and rock are interbedded in spots. The lifts vary from 6 inches to 3 feet. The top and bottom lifts are hard, while the middle of the bed is softer. The product includes all the varieties of marketable stone and is sold to James Maxwell at Glasco.

The following are the operators.

Conlon Bros., Cockburn. Six to eight men are employed throughout the year. A siphon handles all the water.

Hackett & McCormick, Highwoods. Four to five men are employed throughout the year.

Hackett Bros., Cockburn. Three men are employed throughout the year.

Jake Connor, Highwoods. One man works intermittently at this southern end of the opening.

Three quarters of a mile west of the "High bank" ledge a number of quarries have been opened. It is not possible to say whether these quarries are on the same ledge, as there is no continuous opening.

Carle & York, Highwoods. This quarry is situated 1½ miles southwest of Highwoods and more men are employed than in any other quarry in Ulster county. The quarry has not been opened on the outcrop of the ledge, which is the usual rule. The opening is in the shape of a rectangular pit in the middle of a level field. The ledge is worked on three sides of the pit, the perimeter of the face being 425 feet. The dip of the bed is gentle and to the west mainly. The water collects in the western end, and is pumped out by a rotary pump driven by steam. The top is hardpan 3 to 4 feet thick and is troublesome to strip. It is blown off as much as possible with powder, the balance being

handled by shovels and barrows. The bed varies in thickness, varying from 3 to 8 feet, averaging 6 feet. Stone and rock are interbedded throughout the whole bed. The stone is fine grained and of good blue. The top lifts are harder than the lower ones. It is excellent stone for mill work. Side seams are regular and smooth and are from 1 foot to 8 feet apart. No heads are present. The product is sold to the Ulster bluestone co. at Glasco and to the Hudson river bluestone co. at Saugerties. Fifteen men are employed 10 months in the year. $8000 is the value of the product for the season. Quarry is equipped with horse power derrick.

James Van Aken, Highwoods. Quarry is north of Carle & York's. The bed of stone averages 12 feet in thickness, with 7 feet of clay and 5 feet of shale top. The stone is fine grained, of good blue color, reedy and compact. The lifts vary from 6″ to 14″. The reeds in the stone are said to be very tight. Water is troublesome and is handled by a steam-driven rotary pump. Powder is used in quarrying the stone, as well as the top, owing to the absence of heads. The side seams are regular and smooth and 10 to 25 feet apart. Five men are employed during the year. The product of various kinds is sent to James Maxwell at Glasco and Saugerties.

Nelson Felton, Highwoods. This quarry is ½ mile north of Van Aken's. The bed of stone averages 7 feet, with 8 to 10 feet of shale top. A number of slaty seams appear in the bed, which is rather rough. The stone is fine grained, of good blue color and reedy. The lifts vary from 4″ to 12″. The bed pitches to the south and west gently. The side seams vary from 1 foot to 4 feet apart. No heads are present. The product of edge stone is sold to Hudson river bluestone co. at Saugerties. The equipment of the quarry includes steam-driven rotary pump and horse power derrick. Seven to eight men are employed throughout the year.

Van Bramer Bros., Highwoods. This quarry is northwest of Felton's. Bed is 8 to 9 feet thick, 6 feet of which are workable stone, the balance being rubbish interbedded with the stone.

There is not much variation in the quality of the bed. The top is of hardpan 5 feet thick. The stone is a good blue in color, fine grained and reedy. The lifts vary from 8 inches to 3 feet. The product consists chiefly of edge stone, which is sold to James Maxwell at Glasco. Four men are employed during the year. A hand derrick is the only equipment.

William Doyle, Highwoods. One man works on same ledge as Van Bramer intermittently.

Benjamin Meyers, Highwoods. Quarry situated north of Van Bramer. Bed is 5 to 6 feet thick with 7 to 10 feet of rock top. The stone is fine grained, reedy and dark blue. The bed has the usual dip to the southwest. The lifts vary from 2″ to 12″. No heads are present. The product includes all varieties and is sold to James Maxwell at Glasco. Three to four men are employed during the year. The equipment consists of a siphon and hand derrick.

Carle Bros., Cockburn. Bed of stone varies from 2 to 3½ feet in thickness. The top consists of rock and clay 5 feet thick. The stone is fine grained, reedy and of good blue color. The lifts vary from 2″ to 6″. No heads are present and the side seams are variable. The bed dips to the south and west. The product of flag and curb is sold to the Ulster bluestone co. at Glasco. Three to four men are employed.

Wesley Greene, Highwoods. This quarry was stripped of the upper bed and abandoned for 25 years. A lower bed of 2 feet is now being quarried. The top consists chiefly of rubbish from the old bed 3 to 8 feet thick. The stone is fine grained, of good blue color. The product is curb and flag, which is sold to James Maxwell at Glasco and to Ulster bluestone co. at Saugerties. Two to three men are employed nine months in the year. A hand derrick is in use.

James Depuy, Highwoods. Quarry situated 1 mile southwest of Fish Creek. The bed of stone is 4 feet thick, with rough streaks through it, and is about exhausted. Top consists of shale 2 feet thick. The stone is fine grained, of good blue color, and reedy. The lifts vary from 5″ to 6″. Curb and flag are the

principal products, which are sold to Ulster bluestone co. at Saugerties. Three men are employed during the year.

Charles Green, Highwoods. Quarry situated near Highwoods postoffice. The bed of stone is 6 to 8 feet thick and is badly shattered in places. The top varies from 2 to 15 feet of rock and streaks of shale. The bed dips to the southwest. The stone is fine grained, of good blue color, and somewhat reedy. The quarry is being worked toward the east. The lifts vary from 3″ to 12″. The side seams are 2 to 12 feet apart. Product is sold to Ulster bluestone co. at Malden. The equipment consists of horse power derrick and siphon. Four men are employed during the year.

South of the Highwoods district are the quarries near Dutch Settlement. Here, as at other points, the industry has declined of late years. The description of the quarries follows.

John Vederkill, Ruby. Bed of stone 4 feet thick with 6 feet of stripping, of which 5 feet are clay, balance rock. The stone is of fair quality as to color and grain. The lifts are quite heavy. The bed here dips to the north and west. Product is chiefly curb and other edge stone. The product is sold to Ulster bluestone co. Four to five men are employed nine months in the year.

Henry Hart, Ruby. The bed of stone is 2 feet thick with 1 foot of soil top and 2 of rock. The stone is of fair quality regarding color and grain. The lifts are light, flag being the main product. The joints are irregular and tight. Only one man is employed. The stone is sold to James Maxwell at Glasco.

J. A. Longendyke, Ruby. This quarry is near Hart's and on the same ledge. The lifts are somewhat heavier, the product being edge stone. Three men are employed during the year. The product is sold to James Maxwell at Glasco. The quarry is equipped with siphon to drain the water.

Conrad Young, Ruby. The bed of stone is 4 feet with a top rock of 2 feet. The stone is rather fine grained and good blue in color. The bed dips south and west. Some reeds are found in the stone. The product is of all varieties and is sold at

Glasco to James Maxwell. Three men are employed throughout the year.

Charles Steifle, Ruby. Bed of stone is 5 feet thick with 6 feet of rock top. The stone is of good quality. The quarry is the best in the district. The lifts vary from 2″ to 6″. The bed dips to the south and west. Product includes all varieties, and is sold to James Maxwell at Glasco. Four men are employed during the year.

J. Gaddis & Son, Ruby. This quarry is on ledge above Steifle's and is very small. The bed is 3 feet thick, with 5 feet of rock top. The product is sold to James Maxwell at Glasco. Two men are employed.

Jake Stice, Ruby. The bed of stone is 5 feet thick with 10 feet of rock top. The product of flag is of good quality. Lifts are light and easily raised from the bed. The bed of stone rests on pencil. The face of the quarry extends north and south 75 feet. The bed dips to the south and west at a gentle angle. Product is bought by Ulster bluestone co. at Glasco. Three men are employed eight months in the year.

Van Hoevenburg & Nuger, Ruby. The bed of stone is 10 feet thick with 15 feet of rock top. The dip of the bed is to the south and west. The quality of the stone is very fair. All varieties are produced and sold to James Maxwell at Glasco. Three men are employed during the year.

McDonald & Lahey, Ruby. The bed of stone is 4 feet thick with 12 feet of rock top stripping above. The stone is fine grained, of good blue color and somewhat reedy. The bed pitches to the north and west gently. The product including all varieties is sold to James Maxwell at Glasco. Two men are employed.

Hart & Burns, Ruby. The quarry is on the same ledge as McDonald & Lahey's. The bed varies from 5 feet to 7 feet in thickness here, with 5 feet of rock stripping. The water from both quarries collects here and is drained by a pipe. The quality of the stone is the same. The product, chiefly flag, is sold to James Maxwell at Glasco. Three men are employed.

Scheffel & Krell, Ruby. The bed of stone is 8 feet thick, with 15 feet of rock stripping. The stone is of good color and quality. The lifts are quite heavy, producing chiefly edge stone. Water is troublesome and a siphon is in use. The product is sold to James Maxwell at Glasco. Two to four men are employed.

Constance Halbleib, Ruby. The bed of stone is 8 feet thick, with a rock top of 30 feet. The ledge has been worked for 400 yards and was very productive at one time. The stone is of good quality as to color and grain. The lifts are heavy but reedy. The product consists of edge stone, which is sold to Ulster bluestone co. at Glasco. Three men are employed six months in the year.

Sheehan Bros., Ruby. The bed of stone is 8 feet thick, with 25 feet of rock top. The stone is of medium fine grain, good color and reedy. The lifts are quite heavy, ledge stone being produced principally. The product is sold to Ulster bluestone co. at Glasco. Two men are employed throughout the year.

Lannigan Bros., Cockburn postoffice. The bed of stone is 5 feet thick with 10 feet of rock stripping. The stone is fine grained, reedy, and of good blue color. The lifts vary in thickness from 2″ to 6″. All varieties of salable stone are produced, and sold to James Maxwell at Glasco. The quarry is equipped with derrick and horse power pump. Four men are employed during the year.

South from Dutch Settlement are the quarries on Hallihan hill. These are nearly exhausted now, though some are worked intermittently. The only permanent operator is

Chris. McGuire, Katrine. The bed of stone is 4½ feet thick, with 14 to 15 feet of rock top. The stone is of good quality and works fairly well. The product of all varieties is sold to James Maxwell at Glasco. Two to three men are employed intermittently.

Along Sawkill creek a number of quarries have been opened, but only four are in active operation.

H. T. Dickinson, photo.

View of waste weir of Kingston reservoir no. 1, in Sawkill valley, Ulster co. N. Y. looking west, showing ledges of bluestone

T. McDonald, Sawkill. Quarry is situated 250 feet above the bed of Sawkill creek on the north side. The bed of stone is 6 feet thick, with 10 feet of rock top. The stone is of excellent quality as to color and grain. Some powder is used in blasting out the bed, owing to the tight joints. The product, edge stone and rock, is sold to Hewitt Boice at Kingston, who owns the ledge. Six to seven men are employed.

John McCaffery & Co., Sawkill. This quarry is situated in the bed of the creek on the north side. A flume has been put in for keeping the creek waters out of the quarry, which is being worked below the level of the creek. The bed of stone is 10 feet thick, with 12 feet of rock stripping. The bed is somewhat thicker than 10 feet, but is not worked. The stone is of medium grain, of good blue color and reedy. The vertical jointing is all north and south. All varieties of commercial stone are produced, and sold to Hewitt Boice at Kingston. A horse power derrick is in use. Four to five men are employed throughout the year.

W. McCaffery, Sawkill. The quarry is on ledge overlying McCaffery & Co.'s quarry. The bed of stone is 4 feet thick, with rock top of 6 feet. The stone is of the same quality as usual along the Sawkill. Julius Osterhoudt owns the ledge and buys all the stone quarried. One man and one boy employed during the year.

South of the Sawkill is the Jockey hill district. One ledge has been opened for nearly a mile in length, and a number of firms are quarrying stone from it. Two more ledges above the main one have been opened and are being worked on a small scale. This hill was once very productive, but, as in other places in Ulster county, the industry has declined. Old rubbish heaps are to be seen on every part of the hill.

The main ledge averages 8 feet of stone, which is medium grained, grayish blue and somewhat reedy. The stripping is of rock 5 to 6 feet and clay 4 to 12 feet. The ledge is owned by Julius Osterhoudt and Hewitt Boice, to whom the stone is

sold at Wilbur and Kingston. The price of cartage here is based on the number of feet of stone per load. 1c an inch of thickness per square foot of surface is paid for hauling "rock" to market. 6c a linear foot is paid for curbing.

The dip of the ledge is to the north and west. The opening extends north and south, so that the quarries at the northern end receive the water from the other quarries. Owing to different depths of the different workings, water is troublesome in nearly all the quarries. The water is drained by siphons of 2″ cast iron pipes, equipped with a small hand pump at the apex; 10 to 15 feet is the usual fall allowed. These siphons, when the pipe is well jointed, are very efficient, removing a large amount of water in a short time.

The thickness of the lifts varies from the top to the bottom, the top lifts are light, 2″ to 3″, while the lower ones are heavier, 6″ to 10″. Obviously, the top lifts produce flag, and the lower lifts edge stone and rock. Many of the quarries are equipped with a hand derrick for handling the heavy stones. A rough streak appears in some parts of the ledge 2 feet thick and causes some waste. The vertical jointing is north and south, and east and west. Owing to the tightness of these joints, powder is often necessary in the lower lifts.

The following are the operators.

James Howard, Sawkill. Two men employed during the year.

John Murphy, Sawkill. Three men are employed during the year. A siphon is used for drainage.

Thomas Hayes, Sawkill. Five men are employed throughout the year.

Burns Bros., Sawkill. Four men are employed. A hand derrick is in use.

T. McDonald, Sawkill. Ten men are employed throughout the year. The equipment consists of siphon and hand derrick.

B. C. Callahan, Sawkill. Three men are employed.

W. Sheely, Kingston. This quarry used to employ 10 men, but only two are at work now. Water is very troublesome and two siphons are in operation. A hand derrick is also part of the equipment.

H. T. Dickinson, photo.

Bluestone quarry of T. McDonald in bed of Sawkill creek showing sluiceway for water in creek, looking northwest

H. T. Dickinson, photo.

Bluestone quarry of Tom Gad on Jockey hill, Ulster co. N. Y. looking northeast, showing bed of stone and pencil (slate) stripping

William Charlton, Sawkill. Two men employed the year round. Quarry equipped with siphon.

W. F. Watson, Sawkill. Two men employed. A siphon is in use.

Sheehan Bros., Sawkill. This quarry is on ledge above the main Jockey hill ledge and is only opened here. The bed of stone is of rather poor quality and only 4 feet thick. The stripping amounts to from 15 to 18 feet of clay and rock. The ledge is owned by Hewitt Boice, who buys the output at Kingston. Two men are employed.

Tom Gad, West Hurley. Quarry is situated on Morey hill just west of Jockey hill. The bed of stone is 10 feet thick with 20 feet of shale stripping. The face of opened ledge is 250 feet long in a north and south direction. The stone is medium grained and of good blue color. Reeds are present. The side seams are regular and smooth. The product is almost entirely edge stone, which is sold to different buyers in Kingston. Eight men are employed in the quarry.

Mrs J. McRieff, West Hurley. Quarry on same ledge as Gad's, but located on opposite side of the hill. The quality and thickness of bed is the same, but the stripping is 30 feet of shale. The product is sold to Hewitt Boice at Kingston. Two men are employed.

Following this line of quarries south from Jockey Hill, it turns westward in a direction parallel to the Rondout creek through the following quarry districts: Stony Hollow and West Hurley, Morgan hill, Lapala, Atwood, Vly, Scarawan and Mackey hill. The quarries will be described in order.

At Stony Hollow and West Hurley the same conditions hold as in many others of the districts in Ulster county, viz, the beds have been worked out as the stripping has become too heavy for profitable operation.

Owen Grant, West Hurley. Quarry is at Stony Hollow. Bed of stone is 10 feet thick, with an equal amount of stripping of rock. The stone is of excellent quality for curb and cross walks. It is not suitable for building purposes, as small round spots in

the stone stain badly when exposed to the weather. The lifts vary from 4″ to 8″ in thickness. Side seams and heads are both present. The quarry is equipped with horse power pump and two dump carts. The product is hauled to Wilbur and sold to various dealers at Wilbur. Twelve men are employed.

Doyle & Co., West Hurley. The bed of stone is 10 feet thick with 15 to 18 feet of stripping. The stone is fine grained, blue-colored and reedy. The ledge has been opened 100 feet in a north and south direction. The vertical joints are well developed. The product is sold to various dealers at Wilbur. Six men are employed.

T. J. Conroy, West Hurley. The bed of stone is 10 feet thick, with 25 to 28 feet of rock and shale top; the lifts vary from 4″ to 8″; and the stone is very dark blue and fine grained. The systems of vertical joints are well developed. The length of face is 75 feet. The product is sold to the Hudson river bluestone co. at Wilbur. Three men are employed.

James Devine, West Hurley. Bed of stone 12 feet thick, with 20 feet of rock top. The stone is dark blue and fine grained. Reeds are present. The lifts vary from 4″ to 10″ in thickness. The vertical joints are quite tight, and powder is used in blasting out the heavier lifts. The product is sold to the Hudson river bluestone co. at Wilbur. Four men are employed.

John Purcell, West Hurley. Bed of stone is 10 feet thick, with a 10 foot thickness of rock overburden. The stone is dark blue and rather fine grained. The lifts are heavy and are split along the reeds. The vertical joints are tight and powder is used in getting out bottom lifts. The product, chiefly edge stone, is sold to the Hudson river bluestone co. at Wilbur. Three men are employed the year round.

McConnell & Charleton Co., West Hurley. This is a very small quarry with 4 feet of bed and 5 feet of rock top. Face is 50 feet long in a north and south direction. The stone is of the average quality of this district. The product is sold to the Hudson river bluestone co. at Wilbur. Two men only are employed.

H. T. Dickinson, photo.

Bluestone quarry of Owen Grant near Stony Hollow, Ulster co. looking north

Lamb Bros., West Hurley. This is another small quarry with only 3 feet of bed, with 7 feet of stripping. The stone is not as good a blue as is usual in the district, and only small sizes of stone are produced. The quarry is equipped with a siphon. The product is sold to Hewitt Boice, Kingston. Two men are employed.

James O'Neill, West Hurley. The quarry is situated ½ mile southwest of West Hurley. The bed of stone is 8 feet thick, with an average thickness of stripping of 10 feet. The lifts vary from 4″ to 20″. The stone is fine grained and of good blue color. The two systems of vertical jointing are present. The bed dips to the south and west. Some blasting is necessary in quarrying some of the heavier lifts. The Knox system is used. The water is drained by a ditch and horse power pump. The length of face in a north and south direction is 350 feet. The output includes all varieties of marketable stone, and is hauled by wagon to Hewitt Boice at Kingston. O'Neill does his own hauling, and at 70c a ton a profit is made. Ten men are employed 10 months in the year. $6000 is the value of the product per year.

Martin Lane, West Hurley. This is an old abandoned quarry opened up this year. The face is 75 feet long, in a north and south direction. The bed of stone is 7 feet thick with 10 feet of shale and rock top. The stone is of fair quality and quite reedy. The lifts vary from 4″ to 20″ and can be split to almost any thickness. The bed dips to the south and west. The output is sold to various dealers at Wilbur, where it is hauled by wagon. A siphon is in use. Three men are employed.

South of West Hurley and Stony Hollow is the Morgan hill and Hurley woods district. The quarries are nearly all abandoned now, only a few men quarrying regularly. Quarrying and farming are carried on together.

Dunn Bros., Hurley. The bed of stone is 4 to 5 feet thick, with 15 to 18 feet of rock stripping. The stone is of medium grain, of good blue color, and reedy. The lifts vary from 4″ to 8″.

The side seams and heads are well developed. The dip of the bed is to the southwest. The quarry is worked on a very small scale with two men. The product is hauled to Wilbur and Kingston.

Toole Bros., West Hurley. The bed is 4½ feet thick and rather rough. The stripping of rock averages 12 feet. The stone is of medium grain and good blue color. The lifts vary from 4″ to 12″ and are split into various thicknesses along the reeds. This quarry has been extensively worked, but, as the quarrymen say, "the rock has dipped down into the stone." The product of chiefly edge stone is sold to Hudson river bluestone co. at Wilbur. Three men are employed.

The other quarrymen working at various localities in this district are:

Thomas F. Scully, Hurley.

Fred Krantz, Hurley.

Frank McMullen, West Hurley.

In the Lapala and Roseville districts the following quarrymen are working.

Winchell Bros., Lomontville. The bed of stone is 4 feet thick, with 8 to 10 feet of stripping of rock and clay. The stone is of medium fine grain and fair blue color. The lifts vary from 4″ to 5″ and are worked mostly into edge stone. The vertical joint systems are as usual. The dip of the bed is to the north and west. Product is sold to Hewitt Boice at Kingston. A siphon is in use. Three men are employed during the year.

A. De Graff, Hurley. The bed of stone varies from 2 to 6 feet in thickness, with 14 to 18 feet of shale and rock stripping. The stone is of good color and grain, but some rough streaks in the bed make a great deal of waste. The dip of the bed is to the northwest. The quarry is equipped with hand pump. Stone is sold to different dealers on the Hudson. Product, flag and edge stone. Two men are employed.

Clearwater, Conner & Hotaling, Hurley. This quarry is on same ledge as De Graff's, and the thickness of bed and stone is the

same. Different dealers buy the stone. Three men are employed.

Thomas Sampson, Hurley. The bed of stone is only 2 feet thick, but has a light top of 4 feet. The quarry is in the bed of Stony creek. The lifts are 4″ to 6″ thick, producing chiefly edge stone. The grain is fine and the color good. The stone is sold to Julius Osterhoudt at Wilbur. Four men are employed through the year.

W. H. Miller, Lomontville. This quarry is situated on what is known as the Irving ledge, which has been opened for 800 yards in a north and south direction. The bed ranges in thickness from 2 to 6 feet with a top of varying hight. The stone is fine grained, of good blue color, and reedy. The ledge is known for the great amount of large "rock" produced. This is the main product today. The vertical joints are very much stained with iron. The stone is sold to Hewitt Boice and the Hudson river bluestone co. Miller employs three men. Water drained by a siphon.

The following also quarry on this ledge:

Ennis & Jones, Lomontville. Two men employed.

John Clearwater, Hurley. Two men employed.

J. Scriver, Hurley. Three men employed.

William Gooches, Lomontville. Two men employed.

William R. Brodhead, Hurley. The bed of stone averages 6 feet, with stripping of clay, shale and rock of 14 feet. The stone is of the average quality of the district. The lifts vary from 2″ to 8″, and all varieties of stone are produced. A hand pump is used for draining the water. The output is sold to Hewitt Boice at Kingston. Three men are employed.

John J. Sampson, Hurley. The bed of stone is 4 to 5 feet thick, with a rock streak 2 feet thick dividing the bed. The stripping amounts to 9 feet of rock and clay; the latter is 1 foot thick. The product is of all varieties and is of the usual grade of this district. Hewitt Boice at Kingston is the buyer. Three men are employed.

Winchell Bros., Hurley. The bed of stone is 8 feet thick, with a top of shale 25 to 30 feet thick. The stone is fine grained, of good blue color, and reedy. The bed dips to the southwest gently. The ledge has been opened up 200 feet along the side seams. The lifts are heavy, 6″ to 9″, and the product is principally rock. Hewitt Boice owns the ledge and buys all the product. Four men are employed.

Cornelius Goebel, Lomontville. The bed of stone is 6 feet thick, with 12 to 14 feet of rock top. Some stone is taken out of the top rock, but very little. The bed dips north and west. The stone is of the average quality. All varieties of salable stone are quarried, and sold to Hewitt Boice at Kingston. A siphon is in use. Three men are employed during the season.

Robert Elliott, Hurley. The bed of stone is 12 feet thick, with 14 feet of rock stripping. The stone is fine grained, reedy, and of good blue color. The vertical joints are regular and stained badly with iron. The dip of the bed is to the north and west. The lifts vary from 3″ to 10″, giving a variety of products. The quarry is equipped with horse power pump and derrick. Hewitt Boice of Kingston buys the product. Four to five men are employed throughout the year.

The quarries south of the Lapala district are all small in size and number. The region through Atwood and Vly was quite productive at one time. South of Vly the Scarawan quarries are being worked on a small scale. The end of this productive line is at Mackey hill west of Kripple Bush, where a long ledge has been opened.

The following are at work in the vicinity of Vly and Atwood.

Green L. Davis, Atwood. A very small quarry between Atwood and Vly. The bed of stone is 4 feet thick, with 10 feet of rock and dirt top. The lifts vary from 4″ to 8″. The stone is of average quality and is sold at Wilbur to different buyers. One man employed.

Lockwood & Krom, Atwood. This ledge has been opened up for some distance. The bed is 4 feet in thickness, with 6 feet of rock and 1 foot of clay top. The stone is rather coarse

grained and of good blue color. The lifts vary from 2″ to 6″ in thickness. The dip of the bed is to the north and west. The bed is said to work "hard," and the bedding planes are not smooth. The north and south joining is prominent, and the sides are stained with iron. The stone is hauled 12 miles to Kingston and 14 miles to Wilbur. Two men are employed. Besides the above firm the following are quarrying on the same ledge.

George Winchell, Atwood.

Bush & De Boice, Atwood. Three men are employed eight months in the year.

Charles Ennis, Atwood. One man employed.

The quarries in the Scarawan district are as follows.

Turner Bros., Stone Ridge. The ledge of stone is 12 feet thick, in which 3 feet is the thickness of the workable stone. No sharp line of demarcation between the rock and stone is to be seen. The rock and stone are interbedded. The stone is coarse grained, of good blue color and with few reeds. The top lifts are light, producing flag, while the lower lifts are heavier, 5″ to 8″. The north and south joints are prominent. The bed dips to the north and west. Two men are employed.

The following are also quarrying on this ledge.

Snow & Smith, Kripple Bush. Two men are employed eight months.

Wagner & Krum, Kripple Bush. This quarry is on ledge just above Turner Bros. and is of the same character. The bed of stone is 3 feet thick, interbedded with 9 feet of rock. Two men are employed.

The following operate on the same ledge occasionally.

J. H. Beatty, Vly. All the Scarawan quarries haul their stone to High Falls on the canal, where it is loaded on barges for shipment. Julius Osterhoudt is the buyer at High Falls.

Jason Beatty, Kripple Bush. This quarry is situated ½ mile east of the Scarawan quarries, but the stone is of the same quality and character. The bed is 3 feet thick, with 4 feet of rock top. The stone is hauled to High Falls to Julius Osterhoudt. One man is employed.

The opening on Mackey hill is 1 mile long and extends part way around the hill. The bed of stone is 10 to 12 feet thick, with a top ranging from 12 to 35 feet in thickness. The top is entirely shale, which when stripped has not been disposed of well, as the quarries are badly blocked in places with rubbish. The stone is rather fine grained, of good blue color and reedy. The lifts are very heavy, 10″ to 24″. The top lifts do not split well, but the lower ones do. The ledge dips to the south and west, and the water, following the dip, collects at the southern end, where it is removed by siphons. A number of firms are quarrying on the ledge, and many have hand derricks in use. The side seams and head-offs are all tight, sometimes requiring blasting in lower lifts. The product is edge stone and " rock," which is hauled to High Falls on the canal.

The following are quarrymen, all of Kripple Bush.

Osterhoudt & Barley. Two men employed eight months in the year.

Beatty & Vandermark. Two men employed the year round.

W. D. Roosa. Four men employed during the year. The product sold by the quarryman at Port Jackson to various markets. Quarry equipped with hand power derrick.

Davis Bros. Two men employed the year round.

Jacob McMullin. Two men employed the year round.

Rose Bros. Two men employed the year round. Quarry equipped with horse power derrick and pump.

Greene Bros. Two men work intermittently. Quarry equipped with hand derrick and siphon.

O. E. Christian. Two men employed intermittently.

Hector Connor. One man and two boys employed the year round.

To the west of the northern part of this main range of quarries, viz west of the Quarryville, Fish Creek and Highwoods districts, the ledges of stone are terraced one above another, forming as it were the foothills of the Catskill mountains. A number of quarries have been opened in these ledges, but only a few are worked at present. The stone is of poor quality, not evenly

bedded and very apt to "slack" or disintegrate on exposure. Near Fawns a ledge 1½ miles long has been opened, but is now abandoned.

On the eastern face of the mountains, from the Mountain house to Woodstock, and in the Kaaterskill and Plaaterskill cloves quarries are being worked. This stone is known as the mountain stone and differs from the stone quarried lower down in the vertical scale, in color, texture and appearance. The color is very variable, the grain is almost invariably coarse, and few reeds are present. There is less danger from "slacking" or disintegration on exposure, and it is a stronger stone than the fine grained, reedy stone of Quarryville and other similar districts. There is a distinct preference, however, for the typical bluestone; so the mountain stone does not stand high with the buyers.

Quarries have been opened on at least eight different levels on the eastern side of the mountain. On the southern side only one quarry is in active operation. The beds of stone vary in thickness from 4 feet to 12 feet. The amount of top, or overburden, depends on the length of time the quarry has been worked. As the beds are worked out into the mountain, the top increases. When the quarries are first opened, the stone is lighter and sold for flag. As the bed is worked deeper into the side of the mountain, the stone becomes heavier, and rock and edge stone are the chief products. The large sized stones are rock, such as platforms etc.; edge stone is 20 inch curb, sills and jointers.

The top is of rock and slate of a very decided reddish color. This red in places runs into the bed, and a red stone is sometimes quarried, but is looked on with disfavor by the buyers. The beds are of a rather light blue color, which has a greenish tinge when dressed, or after being exposed to the weather. This greenish tinge is typical of the stone from this mountain and of the mountain to the south.

The joints run nearly north and south and east and west. The joints running north and south are known as side seams, while

the east and west joints are called headers. "Blocks" is the name for the strips of stone between the side seams. The stone is quite free from reeds and does not slake after exposure. All splitting is done along the seams. The dip of the bed is very slight on the eastern side of the mountain to the west and south; while on the southern side west and north the beds are nearly horizontal.

The texture, or grain, varies from coarse to fine. It is a usual thing to find that the top lifts of a bed are fine grained, while the bottom lift is quite coarse. The coarse grained stone is stronger and less likely to slake; and is also heavier.

The stone from the different quarries on the mountain does not vary much. The same condition and variations of texture, color, and top are met with at all levels. The quarry openings show a thickness of these alternating beds of shale, rock, and bluestone of 2000 feet. The joints are tight and loose, varying with the different openings. The side seams are in many places stained with iron.

A number of ledges with good beds of stone are exposed, but not opened, as the owners do not care to have the mountain disfigured with the rubbish piles. The top is disposed of mostly by dumping down the mountain side.

The stone is all hauled to Malden and sold to the Ulster bluestone co.

West of Dutch Settlement and West Hurley the bluestone belt widens, stretching over the 500 foot plateau which borders the mountains on the southeast. The stone from this territory is hauled to Brodhead's Bridge and other stations on the Ulster and Delaware railroad.

Beyond Brodhead's Bridge, along the Ulster and Delaware railroad, stone is quarried in the mountains as far as Grand gorge. This stone is of various colors, but is sold in the market as bluestone. The stone is shipped by way of the Ulster and Delaware railroad to Rondout, where it is loaded on barges for shipment to the eastern markets by tide water.

The quarries on the terraces between the mountains and the Highwoods district are as follows:

Hommell Bros., Fawns. Quarry is $1\frac{3}{4}$ miles northeast of West Saugerties. The bed of stone is 8 feet thick, with 15 feet of shale top. The stone is medium grain, of good blue color, but reedy. The lifts are evenly bedded, but the stone works "scallopy." The product is chiefly edge stone, which is sold to Ulster bluestone co. at Malden. Two men are employed intermittently.

Hommell & Ransome, Fawns. Two men employed on same ledge. Quarry equipped with small hand derrick.

Wolven Bros., Fawns. Quarry $1\frac{1}{2}$ miles northeast of West Saugerties and $\frac{1}{2}$ mile south of Hommell Bros. The bed of stone is 4 to 5 feet thick, with 12 to 15 feet of red shale top. The stone is rather coarse grained and a good blue. The bed dips to the southwest. Side seams and heads are present and regular. These vertical joints are tight, making hard quarrying. The lifts vary from 4″ to 6″. Product is chiefly edge stone, which is sold to James Maxwell at Saugerties. Quarry equipment consists of a horse power pump and hand derrick. Two men are employed throughout the year.

The quarries in the vicinity of Palenville are as follows.

Sylvester Stone & Christopher Hawley, Palenville. Quarry northwest of Palenville on the mountain side at an elevation of 1160 feet. The bed of stone is 5 feet thick, with 20 feet of top, one half shale and one half rock. The stone is coarse grained and greenish blue. Some reeds are present, but split very unevenly. The lifts vary from 4″ to 20″. Both side seams and "headers" were present when this ledge was first opened, but the headers have run out. The bed dips to the south and west. The product is chiefly edge stone, which is hauled 13 miles to Ulster bluestone co. at Malden. Two to three men are employed. Two or three loads (3 to 4 tons each) a week are produced 8 months in the year.

Lee Wolven & Frank Simmons, Palenville. Quarry is 250 feet above Stone's. 9 feet of good stone are worked, which is cov-

ered with 18 feet of dirt and loose rock. The stone is of same quality and character as Stone's. The product is sold to Ulster bluestone co. at Malden. Two to three men are employed during the year. Three loads a week of four tons each.

Lyman Lamouree, Palenville. This quarry is 200 feet above Palenville, on the mountain side at an elevation of 780 feet. The quality of bed and character are the same as Stone's. The color is reddish. Bed is 10 feet thick with 20 feet of rock and shale top. One man employed intermittently.

Stewart & Dolan, Palenville. Two men employed very intermittently on the mountain.

P. A. Moon, Palenville. Quarry is situated just south of Otis elevated railroad, 300 feet from base of mountain. The bed is very irregular, 2 to 6 feet thick, with rock stripping of 8 feet. The product is principally flag and is a little more green than usual, but the stone is of poor quality, and the quarry is worked irregularly. Product sold to Ulster bluestone co. at Malden, and also locally. One man and one boy employed.

Frank Symmonds, Palenville. One man employed occasionally on same ledge as Moon. This bed when worked back into the mountain gives out; that is, the stone changes into "rock."

J. H. Wolven, Palenville. Quarry on north side of the Kaaterskill clove, $2\frac{3}{4}$ miles west of Palenville and 500 feet above the bottom of the clove at this point. The bed of stone is 8 feet thick, with 30 to 35 feet of top, including 7 to 8 feet of shale. The stone is of the greenish tinge characteristic of this district, and coarse grained. A few reeds are present. The lifts vary in thickness from 2″ to 8″. The dip of the bed here is north and west. The quarry is worked toward the north, the face running east and west. The product is hauled 15 miles to Ulster bluestone co. at Malden. A hand derrick is in use. Four men are employed during the year and six to seven loads of stone a week are drawn during eight months in the year.

The stone is comparatively soft for mill treatment, but tough, and may "chip out" under a plainer. The quarrymen say they have found streaks of coal and "shiny," in the beds. This latter

is probably pyrites. The same ledge has been opened up farther east, but is not worked there now.

Hommell & Rightmeyer, Palenville. Quarry situated on south side of Kaaterskill clove, opposite Wolven. The bed is thin, 3 feet with 12 to 15 feet of rock t p. The dip is to the southwest, showing gentle roll once existed where the clove has been eroded out. The stone is coarse grained and of greenish tinge. No reeds are present and the seams are irregular. Small pockets of coal and crystals of iron pyrites are found in many of the mountain quarry beds. The stone is hauled to Ulster bluestone co. at Malden. Two men are employed eight months in the year.

Lamouree & Haines, Palenville. Quarry just west of Palenville and 500 feet above the town. The bed of stone is 7 to 8 feet thick, with 15 to 20 feet of rock top. The quality and appearance of the stone are the same as the other stone from these mountains. This has been a very productive quarry. The bed dips to the southwest. The stone is sold to Ulster bluestone co. at Malden. Two men are employed.

W. Fuller, Saxton. Quarry situated 200 feet above Haines. The bed is 20 feet thick, with rock top of 25 to 40 feet. The stone is medium grained and a fair blue color, lacking the usual greenish tinge. The side seams are straight and regular, but the heads are very irregular. The lifts vary from 3″ to 10″. The bed dips to the south and west. The product is sold to Ulster bluestone co. at Malden. Two men are employed.

Valk & Hommell, Palenville. Quarry near Fuller's and below it. The bed of stone is 10 feet thick, with 10 feet of rock top. The bed is quite rough and some rock is interbedded with the stone, which is of medium grain and of greenish tinge. No reeds appear. The bed dips to the south and west. Both systems of vertical jointing are present. Lifts vary from 2″ to 4″. The product, principally flag, is sold to Ulster bluestone co. at Malden. Two men are employed.

M. T. Wasson, Palenville. Quarry is near Valk & Hommell's. The bed of interbedded rock and stone is 12 feet thick, with rock stripping of 14 to 20 feet. This is a very small quarry and

very rough bed. The stone is of the usual character of the mountain stone, and is sold to the Ulster bluestone co. at Malden. Two men are employed.

Arbecker Bros., Palenville. Employing two men.

Howard Winne, Palenville. Employing one man. Work intermittently near Wasson's quarry.

Cook & Ransome, Palenville. Quarry 2 miles south of Palenville, 300 feet above base of mountain. The bed of stone is 8 to 10 feet thick, with rock top of 15 to 18 feet. The stone is of greenish blue color. It is coarse grained and free from reeds. The lifts vary from 2″ to 4″ and are rough. The systems of joining are well developed. The bed dips to the southwest. The quarry is equipped with hand derrick and siphon. The product is sold to Ulster bluestone co. at Malden. Two men are employed the year round.

The quarries in the vicinity of West Saugerties and Plaat Clove are all on the mountains at elevations varying from 400 feet to 2500 feet above the base of the mountains.

On the north side of the Plaaterskill clove the following quarries are in operation.

Hommell Bros., West Saugerties. The bed of stone is 6 feet thick, with 20 feet of rock top. The color is light blue and the grain is coarse. The lifts vary from 3″ to 6″, with few reeds. The bed is rather rough and uneven. Two men are employed.

Hommell & Snyder, West Saugerties. The bed of stone is 8 to 10 feet thick, with 30 to 35 feet of rock top. The stone varies in grain from fine in the top lifts to very coarse in the lower ones. The lifts vary from 4″ to 20″. Some reeds are present, along which the stone splits evenly and readily. The stone is blue, but has the greenish tinge typical of the mountain stone. The dip of the bed is west and south. The stone is sold to Ulster bluestone co. at Malden. Three men are employed the year round.

George Young, Plaat Clove. The bed of stone is 10 to 12 feet thick, and there are 15 feet of rock top. The stone is coarse grained and greenish blue. The bed is quite rough, and there

is a great deal of waste in quarrying. The side seams are quite irregular.. The lifts vary from 3″ to 12″. The product includes all varieties, and is sold to James Maxwell at Saugerties. Two men are employed eight months in the year.

Wase & Burt, Plaat Clove. This quarry is 1½ miles northwest from Plaat Clove postoffice. The bed of stone is 4 to 5 feet thick, with 12 to 15 feet of top, the most being hardpan. The stone is light blue with a greenish tinge and quite coarse grained. It is too hard for mill treatment. The vertical joining is very irregular. The lifts vary from 3″ to 4″. The product is chiefly thick flag, which is sold to James Maxwell at Saugerties. Two men are employed.

Schoonmaker & Young, Plaat Clove. This quarry is on the same ledge as Wase & Burt's, but the bed has thinned out to 2 to 2½ feet. The character and class of stone and products are the same. The product is sold to James Maxwell. Two men are employed intermittently.

Abraham Hommell, West Saugerties. Employed in quarrying on the north side of the clove at different localities.

On the south side of the clove and on the Plaaterskill mountain the following quarries are being worked.

Delemater & Hommell, West Saugerties. The bed of stone is 12 feet thick, with 10 feet of shale and rock top. The stone is coarse grained, of good blue color and free from reeds. The lifts vary from 1″ to 6″. The dip of the bed is to the south and west, in contrast to the north and west dip of the beds on the north side of the clove. The vertical joints are quite irregular and stained with iron. The product is chiefly flag, which is sold to Ulster bluestone co. at Malden. Two men are employed.

Becker Bros., West Saugerties. This quarry is on the same ledge as Delemater & Hommell's. The quality of the stone is the same, though the bed and top are not so heavy, being 8 feet and 10 feet respectively. The product is sold to Hudson river bluestone co. at Saugerties. Two men are employed.

Snyder & Hommell, West Saugerties. This is on same ledge as the two previous quarries, and the quality and color of stone

are the same. The bed is 7 feet thick, with 12 feet of hardpan top. The product is sold to James Maxwell at Saugerties. Two men are employed the year round.

Erby & Egner, West Saugerties. The bed of stone is 9 to 14 feet, with a top of 50 to 65 feet of rock with shaly streaks. The stone is of fair quality regarding grain and color, and is soft enough for mill treatment. The quarry will be abandoned soon on account of the thickness of the top. The stone is sold to James Maxwell at Saugerties. Two men are employed eight months in the year.

Rightmeyer & France, West Saugerties. This quarry is on the northwest side of Plaaterskill mountain, 2300 feet above West Saugerties. The bed of stone is 5 to 6 feet thick, with 10 to 15 feet of rock top. The stone is gray and of medium grain. The seams are $\frac{3}{4}''$ to 4″ apart and are very even. The product is chiefly flag, and is hauled 12 miles to James Maxwell at Saugerties. Two men are employed throughout the year.

Ethan Yeager, West Saugerties. The quarry is just being opened on the same ledge with Rightmeyer & France's quarry.

Huff & Young, West Saugerties. This quarry is also on same ledge as Rightmeyer & France's, but farther east. The dip of this ledge is southwest. Stone is the same in color and texture along the ledge, but rougher. The product of flag is sold to James Maxwell. Two men are employed throughout the year.

John Shalk, West Saugerties. This quarry is situated on south side of the Plaaterskill mountain, 2450 feet above West Saugerties. There are two beds of stone worked, separated by shale and rock. The top bed is 4 feet thick and the bottom bed 5 feet. The stripping amounts to 10 feet of rock and clay. The lifts are light, $\frac{1}{2}''$ to 5″. The chief product is flag, which is sold to James Maxwell. The stone has a reddish tinge and is medium grained, and free from reeds. The seams are quite regular and smooth. One man employed.

Patrick Callahan, West Saugerties. The bed of stone is 3 feet thick, with 15 to 20 feet of rock top. The stone has a reddish tinge and is rather finer grained than the usual mountain stone.

The vertical jointing is quite irregular. The stone is carted to James Maxwell at Saugerties at an expense of 33⅓% of the value of the load. One man is employed.

Abraham Steamburgh, West Saugerties. The bed of stone is 7 feet thick with 20 feet of rock top. The stone is of the mountain character, coarse grained, reddish tinge and free from reeds. The product is all flag, and is sold to James Maxwell. Two men are employed eight months in the year.

Becker Bros., West Saugerties. The bed of stone is 5 feet thick, with 10 to 12 feet of rock top. The stone is coarse grained, of reddish tinge, and some reeds are present. The lifts vary from 2″ to 3″. The vertical joints are smooth and regular. The stone is soft enough to be worked in the mill. The product is chiefly flag, and is sold to different dealers at Saugerties. Two men are employed during the season.

Charles Cole, Plaat Clove. The bed of stone is 3 feet thick, with 12 to 15 feet of shaly rock top. The bed dips, as is usual in this district, to the west and south. The stone is of medium grain and reddish tinge. The product is mainly flag, as the lifts are quite thin. One to two men are employed.

Teetzel & Burt, Plaat Clove. The quarry is situated 2½ miles west of Plaat Clove postoffice. The bed of stone is 4 feet thick, with 25 feet of rock top. The stone is light colored blue, coarse grained and free from reeds. The bed dips to the south and west. The product is principally flag, and is sold to James Maxwell at Saugerties. The quarry is equipped with hand derrick. Two men are employed.

Dale & Bunt, Plaat Clove, are just opening a quarry in this district, employing two men.

Snyder & Lindsay, Plaat Clove, are likewise opening a quarry, employing two men.

Between West Saugerties and Woodstock numerous quarries have been opened at the base of the mountains and on the eastern face. The following are operating.

Myers & Doyle, West Saugerties. This quarry is 1½ miles southwest of West Saugerties, 1250 feet above the town. The

bed of stone is 12 to 15 feet thick, with 25 feet of red shale and clay top. The top 4 feet of bed are red stone, while the lower part is light blue. The stone is all coarse grained. The bed is rather rough and hard to work. The vertical jointing is regular and smooth. The ledge has been opened up for 300 feet along the side seams. The product includes all varieties, and is sold at Saugerties to different dealers. Three men are employed throughout the year.

Bach & Burton, West Saugerties. Quarry is 2½ miles south of West Saugerties and 300 feet above the base of the mountain. The bed of stone is 12 to 14 feet thick, with 25 to 30 feet of shale rock and clay top. The stone is coarse grained, of light blue color and somewhat reedy. The dip of the ledge is to the south and west. The lifts vary from 2″ to 14″ in thickness. The thicker lifts must be split to 6″, or the reeds will open. The side seams and heads are regular and open. The product consists of edge stone and rock, which is sold to Hudson river bluestone co. at Saugerties. Two men are employed.

Plass & Byer, West Saugerties. This quarry is south of Bach & Burton's and above it. The bed of stone is 6 to 7 feet thick, with a rock top of 20 feet. The stone is rather fine grained and of fair blue color. Reeds are present. "Niggerheads," or round boulders, in the bed make it hard to work. The product is principally flag, which is sold to Hudson river bluestone co. at Saugerties. Two men are employed.

Fred Snyder, West Saugerties. This quarry is situated 2 miles south of West Saugerties at the foot of the mountain. The bed of stone is 8 to 9 feet thick, with 18 to 20 feet of rock top. The stone is dark blue and rather coarse grained. The vertical jointing is rather irregular, but both systems are present. The product is sold to James Maxwell at Saugerties. The quarry is equipped with hand derrick. Three to four men are employed during the year.

Doyle & Clove, West Saugerties. This quarry is near Snyder's, but on ledge below. The bed of stone is 6 to 7 feet thick, with 10 to 15 feet of shale top. 1 to 2 feet of rock are interbedded

with the stone. The dip of the ledge is to the south and west. The stone is light blue and fine grained. Some reeds are present. The product is chiefly flag, as the lifts are light. The stone is sold at Saugerties to various dealers. Two men are employed throughout the year.

Albert Doyle, West Saugerties. Two men are employed in quarrying on the same ledge as Doyle & Clove, just south.

Oliver Holden, West Saugerties. The bed of stone is 15 feet thick, but on account of rough streaks there is a large amount of waste. 15 feet of shale cover the bed. The stone is of medium grain, fair blue color and reedy. This ledge has been opened for 250 feet in a north and south direction. The dip is to the west and south. The product is sold to the Hudson river bluestone co. at Saugerties. Four to five men are employed during the year.

Lawrence Wolven, West Saugerties. This quarry is on the same ledge as Holden's, but south. The bed is but 4 feet thick here, with 10 to 12 feet of shale top. The bed is badly broken up, but the stone is of the same character as Holden's. The joints are open 3″ to 4″. Two men are employed the year round.

In the vicinity of Daisy several small quarries have been opened.

Burton Bros., Daisy. Quarry is situated ½ mile south of Daisy. The bed of stone is 8 to 10 feet thick, with a rock top 10 to 20 feet thick. The stone is quite dark blue and of medium grain. The ledge has been opened 300 feet along the strike. The bed dips to the north and west. A stratum of shale appears between the bed and top rock. The thickness varies from 1 to 4 feet. The lifts vary from 3″ to 10″. The product, of various varieties, is sold to James Maxwell at Saugerties. Three men are employed.

The following operators also quarry on this ledge.

Abraham Cole & Son, Daisy. Two men employed throughout the year.

John Van Etten & Son, Daisy. Two men employed.

Peter Mower, Daisy. One man employed.

Ellis Wolven, Woodstock. Quarry is situated 1½ miles southwest of Daisy, and 1½ miles east of Woodstock. The quarry is a pit in the open field. The thickness of bed is 4 to 5 feet, with 1 to 2 feet of rock and 6 to 7 feet of clay top. The stone is dark blue and rather fine grained, and reeds are present in top lifts. The dip of the bed is to the northwest. The lifts vary from 3″ to 22″. The product is chiefly edge stone, which is sold to Ulster bluestone co. at Malden. Three to four men are employed during the year.

In the vicinity of Woodstock the following operators are working.

N. Mower, Woodstock. Quarry is on a ledge (1 mile east of Woodstock) which has been opened for some length. The bed of stone is very rough and 2 to 4 feet thick. The overburden is 8 to 10 feet of rock. The dip is to the west and north. The stone is fine grained in upper lifts and coarse in lower. It is of good blue color. The vertical joints are somewhat irregular and stained with iron. The product is sold to James Maxwell at Saugerties. The quarry is worked intermittently by two men.

Canine & Longendyke, Woodstock. Quarry on same ledge as Mower's. Two men employed intermittently.

Egbert Schoonmaker, Woodstock. Quarry is situated ½ mile east of Woodstock. The bed of stone is 6 to 7 feet thick, with 4 to 5 feet of rock and clay top. The bed is very irregular and dips rather sharply to the north and west. Water collects at the lower end and is drained by a siphon. The stone is medium grained and of dark blue color. Some pyrites is found in the bed and affects color of stone on exposure. The lifts vary from 2″ to 12″, and all varieties of stone are produced, and sold to James Maxwell at Saugerties. Two men employed during the year.

Levi Mann, Woodstock. Quarry situated ½ mile north of Woodstock. The bed of stone is 3 feet thick on an average, but is very irregular and rough. The top is of rock 8 feet thick. The stone is fine grained and reedy. The bed dips to the north

and west at changing angles. The product of edge stone and rock is sold to James Maxwell. Two men are employed intermittently.

On the southeastern side of Overlook mountain several ledges have been opened and worked extensively. The quarries known as the "California" quarries were very productive, but have not been worked in some years on account of the very heavy top. The same ledge, however, has been opened to the north, and five different firms are quarrying. The bed of stone is 11 to 13 feet thick, with 18 to 30 feet of rock top. The stone is fine grained, reedy and of light blue color. The top lifts have a reddish tinge. The stone is split into thin layers, for, if left thick, the reeds weather open. The ledge dips to the west and north. The product, chiefly of flag, is sold to Hudson river bluestone co. and to James Maxwell.

The following are the operators, all of Woodstock.

M. Elliott. Four men employed.

McGhee & Waste. Three men employed.

McGhee & Herrick. Four men employed.

Edward McGhee. Four men employed. The quarry equipped with hand derrick.

Peter Keegan. Three men employed.

James Riley. This quarry is on a ledge below Elliott's. The bed of stone is 7 to 8 feet thick, with 10 to 15 feet of rock top, 4 feet of which are slaty. A shale parting appears between stone and rock. The stone is of medium grain, light blue and reedy. The lifts vary from 5″ to 6″. The bed dips gently to the north and west. Both systems of vertical jointing appear. The product is sold to James Maxwell at Saugerties. Four men are employed.

Whittaker Bros., employing two men and **Jack Murray** employing one, have small quarries on the side of Overlook mountain.

In the vicinity of Bearsville, 2 miles west of Woodstock, the following quarries are in operation.

Charles Yerry, Bearsville. Quarry 1 mile southwest of Bearsville on the side of the hill. The bed of stone is 6 to 7 feet thick,

with 12 feet of rock top. The stone is of fairly good color and medium grain. The quarry has been extensively worked. The dip of the bed is to the north and west. The upper lifts produce flag and the lower ones edge stone, all of which is sold to Hudson river bluestone co. at Saugerties. The vertical jointing is quite irregular. One man employed intermittently.

Snake rock quarries

These quarries are on a low hill 1¼ miles south of Bearsville. The ledge has been opened 800 feet around the hill. The bed of stone is 10 to 12 feet thick, with 30 feet of rock top. The stone is of medium grain and fairly good blue color with a reddish tinge. The lifts are rather heavy, and the product consists of rock and edge stone. The bed dips to the north and west. The vertical jointing is regular and smooth. What water collects at the lowest point is drained by a siphon. The product is sold to Hewitt Boice at Kingston, and to the Hudson river bluestone co. at Saugerties. The cost of haulage is 50% of value of load.

The following are the operators.

Oscar Lasher, Woodstock. Five to six men employed during the season. Quarry equipped with derrick.

Brower & De Graff, Glenford. Three men employed during the year.

Stoutenburgh & De Graff, Glenford. Three to four men employed.

Stratton & Davis, Woodstock. Two men employed.

Bonsteil Bros., Woodstock. Two men employed.

John Hasenpflug, Glenford. This quarry is on ledge below the above quarries. The bed of stone is 4 to 5 feet thick, with 25 feet of rock top. The stone is of the same character as the ledge above. The lifts vary from 3″ to 8″. The product is mainly rock, which is sold to Hewitt Boice at Kingston. One man employed.

Flowers & Brower, Glenford. Quarry is situated on same ledge as Hasenpflug. Two men employed.

A. E. Shultis, Bearsville. Quarry situated 2 miles west of Bearsville. The bed of stone is 6 feet thick, with 8 to 9 feet of rock top. Red shale appears in top also. The stone is fine grained and of poor blue color. The bed dips to the west and north. The lifts are light, the product being nearly all flag. Two men are employed occasionally.

Samuel Shultis, Bearsville. This quarry is just west of Shady postoffice on the hillside 200 feet above the town. It is on a ledge which has been opened up in numerous places. The bed of stone is 6 to 8 feet thick, with 15 to 20 feet of top, mostly of red shale. The stone is fine grained, reedy and of poor color. The product is mainly flag. Three men employed.

George Leppo jr, Shady postoffice. Quarry $2\frac{1}{4}$ miles north of Shady. The bed of stone is 4 to 5 feet thick, with top of rock varying in thickness from 4 to 15 feet. The stone is coarse grained and light blue in color. The lifts vary from 1″ to 3″, the chief product being flag. The stone is hauled to Wilbur, 20 miles distant, and sold to Hudson river bluestone co. Three men are employed.

George Leppo sr, Shady postoffice. Quarry is $\frac{1}{4}$ mile northeast of that of George Leppo jr. The bed of stone is 6 to 7 feet thick, with 10 to 15 feet of rock top. The stone is of the same character as that just described. All varieties are produced, and sold to James Maxwell at Saugerties. Three men are employed.

Henry Carle, Lake Hill. Quarry is 1 mile north of Lake Hill in Mink hollow. The bed of stone is 4 feet thick, with 12 feet of rock top. The stone is of coarse grain and fair color. Some reeds are present, but they are very tight. The lifts are very heavy, 6″ to 12″. The stone was used for the Cooper lake reservoir dam. The lifts are too heavy for flag or edge stone. The face of the quarry runs north and south, and at the northern end the dip of the bed is to the north, while at the southern end the dip is to the south, showing a roll in the middle. Four men are employed intermittently.

C. Shultis, Willow postoffice. Quarry 2 miles north of Willow postoffice. The quarry is very small, the bed of stone being 4

feet thick, with 8 feet of rock top. The stone is fine grained and reedy, and is sold as flag to Hudson river bluestone co. at Saugerties, 21 miles distant. Two men are employed.

In the vicinity of Glenford the following quarries are in operation.

E. Miller, West Hurley. The quarry is 2 miles north of Glenford. The bed of stone is 3 to 4 feet thick, with 12 to 15 feet of rock top. The stone is coarse grained and of good blue color, and a few reeds are present. The dip of the ledge is to the west and south. The lifts vary from 5″to 18″ in thickness. The vertical joints are regular, but tight. The stone is sold to Julius Osterhoudt at Wilbur. Three men are employed.

John Jones, Woodstock. Quarry is on ledge 200 feet above Miller's quarry. The bed of stone is 5 to 6 feet thick, with 20 feet of top, 7 feet of which are rock, the balance shale. The stone is fine grained, of fair blue color and so reedy that the lifts have to be split thin to insure the stability of the stone. The thickness of the lifts varies from 3″ to 6″. The bed dips to the west and north. The product of flagstone is sold to Hudson river bluestone co. at Saugerties. Three men are employed.

Abraham Van Etten, Woodstock. The quarry is very small and is 2 miles northeast of Glenford. The bed of stone is 4 feet thick, with 10 to 12 feet of rock. The stone is fine grained, light blue and reedy. The product is principally flag. Two men are employed during the year.

Philip Brower, Glenford. Quarry 1 mile west of Glenford. The bed of stone is 5 to 6 feet thick, with 8 to 10 feet of interbedded shale and rock. The stone is of medium grain and good color. The bed is very irregular, and the dip is to the north and west. The vertical joints are regular and smooth. The product is sold to Rogers & Tappan at Wilbur. Two men are employed.

Kittle & Co., Glenford. Quarry situated 1¾ miles west of Glenford and just being opened. Four men are employed.

John Gross, Glenford. Quarry is 1½ miles west of Glenford. The bed of stone is 10 feet thick, with a rough streak 1½ feet thick in center of bed. The top consists of 13 feet of rock and

7 to 8 feet of clay. The lifts vary from 2″ to 7″. The stone is of medium grain, a dull blue color, and reedy. The product includes all varieties of edge stone and is hauled to Wilbur, 12 miles distant, at a cost of 90c a ton. Two men employed.

Wallace Grey, Glenford. The quarry is situated on hill 1 mile north of Glenford. The bed of stone is 7 to 8 feet thick, with a rock top of 20 feet. The stone is of good blue color, of medium grain, and reedy. The product is sold at Wilbur to various dealers. One man is employed.

Burkins & Flowers, Glenford. Quarry is ½ mile northeast of Glenford. The bed of stone is 10 feet thick, with 10 to 12 feet of rock overburden. The bed is somewhat rough, but the stone is of fair quality, fine grained and blue. Some reeds are present. The dip of the ledge is to the north and west. All varieties of stone are produced and sold to Rogers & Tappan at Wilbur. Two men are employed.

Johnson & Piert, Glenford. This quarry is situated on same ledge as Burkins & Flowers's. Two men are employed.

McAuliffe & Terwilliger, Ashton. Quarry is situated just north of Temple pond and 2 miles southwest of Glenford. The bed of stone is 7 to 8 feet thick, but stone and rock are interbedded, causing a great deal of waste. The top consists of soil and rock 2 to 3 feet thick. The stone is of medium grain, of dark blue color, and free from reeds. The lifts vary from 1″ to 5″. The dip of the bed is gentle to the north and west. The side seams are uniform and smooth, but the heads are quite irregular. The product is flag and edge stone, and is sold to Rogers & Tappan at Wilbur. Two to four men are employed.

Ostrander & Brower, Glenford, two men employed, and **D. E. Hyatt,** Ashton, one man employed, also quarry on this ledge adjoining McAuliffe & Terwilliger's.

David Firman, Shokan. Quarry 1 mile northwest of Temple pond on hillside. The bed of stone is 6 feet thick, with 10 to 12 feet of rock stripping. The dip of the bed is to the west and north. The vertical jointing is irregular. The stone is fine grained and of good blue color. One man is employed.

Robert Secor, Olive. One man employed on ledge adjoining Firman's.

John Russell, Ashton. Quarry is on ledge below Firman's. The bed of stone is 5 to 6 feet thick, with 5 to 7 feet of rock and clay top. The quarry is just opened. The grain of the stone is medium, and the color blue. One man employed.

Chase & Barclay, Ashton. Quarry situated 2 miles east of Boiceville. The bed of stone is 4 to 5 feet thick, with 10 to 15 feet of rock top. The bed dips very gently to the north and west. The stone is very dark blue, fine grained and reedy. The side seams and heads are well developed. The product is chiefly flag, which is sold to different dealers at Wilbur. Two men are employed.

Oliver Hughes, Ashton. Quarry situated 1 mile northeast of Ashton postoffice. The bed of stone is 4 to 5 feet thick, with rough streaks in it. The top is 4 feet thick and is of rock. The stone is fine grained, a good blue and free from reeds. The dip is to the west and south. The product is chiefly flag, which is sold to Rogers & Tappan at Wilbur. The cost of cartage is 85c a ton. One man employed intermittently.

Jones & Co., Ashton. Three men employed in quarry adjoining Hughes's on same ledge.

Greene & De Graffe, Ashton. Quarry 3 miles east of Ashton postoffice. The bed of stone is 4 feet thick, with 8 to 9 feet of rock and 1 foot of clay top. Streaks of shale appear in bed, which is rather rough. The dip is to the west and south. The stone is fine grained and of good blue color. The lifts vary from 2″ to 6″. The product is chiefly flag, and is sold to Rogers & Tappan at Wilbur. Two men are employed.

Hewitt Boice has a mill and dock at Brodhead's Bridge, and the stone from the territory south is hauled there. The prices paid the quarrymen are 15% to 20% lower than at the river docks, on account of the extra cost of freight to Rondout, which is 90c a ton. The quarries follow.

Beesmer & Hover, Olivebridge. Quarry situated ½ mile southeast of Olivebridge. The quarry is just opened. The bed is 4

feet thick, with 7 to 8 feet of rock stripping. The stone is of medium grain and good blue color. The product is sold to Hewitt Boice at Brodhead's Bridge. The quarry is equipped with hand derrick. Three men employed.

Van Kleek & Dudrey, Brodhead's Bridge. The quarry is on south side of Esopus creek, ¼ mile from Olivebridge. The workable bed of stone varies in thickness from 6 to 10 feet. A rough streak appears 3 feet below top of bed. The rubbish is dumped into the bed of the creek. The stripping is of rock 5 to 8 feet thick and 1 to 2 feet of soil. The stone is fine grained and of poor blue color. The vertical joints are uneven and stained with iron. The product is sold to H. Boice at Brodhead's Bridge. Two men are employed.

Eckert & Beesmer, Olivebridge. Two men employed.

Barton & Lyons, Olivebridge. Quarry on the ledge adjoining Van Kleek & Dudrey's, two men employed.

Aaron Bishop, Olivebridge. Quarry 1 mile southeast of Olivebridge. The bed of stone is 10 feet thick, with rock top of 14 feet. The dip of the bed is to the north and west. The stone is of medium grain and good blue color. The quarry is equipped with hand derrick. The product is sold to H. Boice at Brodhead's Bridge. Two men employed.

Howard Barton, Olivebridge. Quarry is situated on ledge above Bishop's. The bed of stone is 5 to 6 feet thick, with 15 feet of stripping of shale and clay. The stone is fine grained and of good blue color, but has a reputation for slaking. The product is sold to Hudson river bluestone co. at Wilbur. Two men are employed.

Dudley & North, Olivebridge. Quarry on ledge below Bishop's. The bed of stone is 2 to 3 feet thick, with 4 to 5 feet of stripping. The stone is of same quality as Bishop's. The product is chiefly flag, and is sold to H. Boice at Brodhead's Bridge. Two men employed.

Cornish & Bush, Olivebridge. Quarry is 3 miles southeast of Olivebridge. The bed of stone is 3 feet thick, with 5 feet of rock top. The stone is of ordinary quality and runs in heavy

lifts. The product is chiefly rock, and is sold at Brodhead's Bridge and Kingston. Two men employed intermittently.

George Winne, Olivebridge. Quarry 3½ miles southeast of Olivebridge. Bed of stone is 5 feet thick, with 12 feet of rock top. The quality of the stone is ordinary. The bed is about worked out. The product is carted to Brodhead's Bridge. Quarry is equipped with hand derrick. Two men employed intermittently.

A. Barton, Olivebridge. Quarry 4 miles southeast of Olivebridge. The bed of stone is 4 to 5 feet thick, with a rock top of 8 feet, and 2 feet of clay additional. The quality of the stone is common. The lifts vary from 2″ to 10″. The dip of the bed is to the north and west. The vertical joints are uniform and smooth. The product includes all varieties, and is sold to H. Boice at Brodhead's Bridge. Quarry is equipped with horse power derrick. Three men are employed during the year.

Merrihew ledge

This ledge is situated 4½ miles south of Olivebridge and has been opened up 500 feet in an east and west direction. A large amount of stone has been produced, but the top is becoming too heavy for profitable work. The bed of stone is 4 to 5 feet thick, with 7 to 8 feet of rock, and 5 to 6 feet of clay overburden. The stone is close grained and of fair blue color. Few reeds appear in the lifts, which vary 2″ to 6″. The bed dips to the north and west gently. The systems of jointing are well developed in the ledge. The product includes all varieties of marketable stone. The following are the operators, all of Olivebridge.

Resne & Keator. Two men employed nine months in the year.

Ezra Palen. One man employed.

Carson & Merrihew. Two men employed.

Christiana & Beesmer. Two men employed.

G. De Witt. One man employed.

Egbert Van Kleek, Olivebridge. The quarry is situated 2½ miles southwest of Olivebridge. The bed of stone is 4 feet thick, with

12 to 15 feet of shale and rock top. The stone is of fair quality and comparatively free from reeds. The product is chiefly rock, which is sold to H. Boice at Brodhead's Bridge. One man is employed intermittently.

Michael Riley, Olivebridge. This quarry is 4 miles southwest of Olivebridge. There are three distinct beds of stone worked in this quarry, divided by shale. The top is of shale 14 feet thick, below which the first bed is 3 feet thick. A bed of shale 3½ feet thick separates this from the second bed which is 3 feet thick. Another bed of shale 4 feet thick separates the second from the third bed, which is 6 feet in thickness. The stone is fine grained and of good color. Some reeds are present. The bedding planes are very smooth and regular. No heads appear in the quarry, but the side seams are uniform. The product is chiefly rock, which is sold to H. Boice at Brodhead's Bridge. Four men are employed the year round.

George Chambers, Samsonville. A small quarry east of Samsonville. The bed of stone is 4 feet thick, with rock top of 10 to 12 feet. The dip is to the north and west. The stone is of ordinary quality. The product is sold at Brodhead's Bridge to H. Boice. One man is employed intermittently.

List of buyers on the Hudson river[1]

Hewitt Boice, Kingston

Three yards and mills at Rondout, Kingston and Brodhead's Bridge.

Rondout. There is a mill with three planers, two gang saws, one rubbing bed, one borer. The dock is equipped with four steam power derricks and a blacksmith shop.

Kingston. Dock is on Ulster and Delaware railroad, and is equipped with mill with three planers, three gang saws and one rubbing bed. Two steam derricks are in use in the yard.

Brodhead's Bridge. The mill is equipped with two planers and two gang saws. Two steam hoisting derricks are in use. Em-

[1]For a statement of the present administrative conditions of the bluestone industry in this region and its consolidation under "Hudson river bluestone co." on Mar. 1, 1901, *see* p. 104.

ployees in three yards, 90. Five barges and one schooner are in use for transporting the stone to market.

Value of business per year, $300,000 to $350,000 (estimated).

Hudson river bluestone co. Rondout

Docks at Malden, Saugerties, Glasco, Rondout and Wilbur, with mill equipment as follows:

Malden. Eight saws, eight planers, two rubbing beds, two boring machines, five steam derricks.

Rondout. Eight saws, nine planers, two rubbing beds, one boring machine, two steam derricks, one traveling crane.

Wilbur. Four saws, six planers, two rubbing beds, one boring machine, four steam derricks.

Employ about 200 men yearly and operate 15 barges.

Value of business, about $500,000.

Julius Osterhoudt, Rondout

Docks at Wilbur and High Falls.

Wilbur. The mill is equipped with three gang saws, one rubbing bed, three planers and one boring machine. Three steam power derricks are in use on the dock. 40 employees.

High Falls. One hand power derrick is in use. Four employees.

Five barges and one schooner are used for transportation.

Value of business per year, $175,000.

Ulster bluestone co. Malden

Docks at Malden and Glasco.

Malden. Mill is equipped with 10 saws, eight planers, two rubbing beds and one borer. 50 men are employed. Five steam derricks are in use in the yard.

Glasco. One hand derrick is the equipment. Three employees. Four barges are in use.

Value of business per year, $250,000 to $350,000 (estimated).

James Maxwell, Saugerties

Docks at Saugerties and Glasco. No mill at either place. One hand derrick at Saugerties. 20 employees.

Condition of the bluestone industry in Ulster county

The quarries within easy hauling distance of the river docks are becoming worked out. This does not mean that the beds of stone are worked out in all cases, but the stripping in many places has become so heavy that no profit is left to the quarrymen after paying rental and cartage. The beds dip to the west at a small angle 5° to 6°, and, with the crude methods used when the top reaches a thickness $2\frac{1}{2}$ to 3 times (with a few exceptions) that of the bed of stone, the profit vanishes. The workable beds are also limited in extent. This is true in both the two main districts. Probably in the vicinity of Saugerties, the most productive district, not one half as many men as formerly are working now. A great many of the quarrymen have gone back to the mountains or along the Ulster & Delaware railroad, or into Delaware, Broome and Sullivan counties. The cost of cartage from the mountains to the river is very high, running up to 50% of the value of a load. Freight on the Ulster & Delaware railroad is also quite high.

QUARRIES IN BROOME, DELAWARE AND SULLIVAN COUNTIES

The quarries in these counties have been opened on the hillsides, on both banks of the Delaware river in New York and Pennsylvania, as far north as Tuscarora in Broome county, and south to Pond Eddy in Sullivan county.

The product of these quarries reaches the market by the way of the Erie railroad. Bluestone is also quarried along the main line of the Ontario and Western railroad from Franklin Depot in Delaware county to Hurleyville in Sullivan county, and along the Port Jervis and Monticello railroad.

A few quarries have been opened along the Delhi branch of the Ontario and Western railroad. Switches have been put in at convenient points on the lines of the railroads for shipping the stone. The buyers have small docks at these switches. Few mills are established in this district, the rock for mill treatment being shipped in the rough to mills nearer the markets.

The stone quarried in these counties differs from the Ulster county product in several characteristics. It is softer, it

works east and west instead of north and south. It is coarser grained. The color is not so good, tending toward a gray. It is less liable to slaking, and fewer reeds are found in the lifts.

The ledges of stone are more pockety than the Ulster county stone. The vertical jointing is more irregular, specially the east and west joints. Less shale is found in the stripping, and the dip is not persistent in any one direction.

The quarries have nearly all been opened high up on the hills; so the drainage is natural. "Black jack" and "sap" are peculiarities of these quarries alone. "Sap" rock is the discolored greenish gray stone which is near the joints. The discoloration extends into the bed from 1 to 3 feet on each side of the joint. "Black jack" is a soft, claylike material, which occurs in the ledges in lens-shaped forms. It crumbles under the hand and contains a great deal of iron. It is due to an alteration of the rock, and when occurring may, as the quarrymen say, "eat out" the whole bed and ruin the quarry.

The prices paid the quarrymen are much lower than at the docks on the Hudson, because of the difference in cost of transportation to market. But the proximity of the railroads lessens the cartage charges.

In the isolated districts business seems to be in a fair condition, with an active demand at Oxford.

Quarries in Delaware, Sullivan and Broome counties

Deyo & Son, Franklin Depot. Quarry is situated 1¼ miles west of Merrickville station on the Ontario and Western railroad and ¾ of a mile east of Franklin Depot.

Vertical section shows

Soil	2	feet
Stone	2	feet
"	2	feet
Rock	1	foot
Stone	2	feet
Shale	6″	
Rock	2½	feet
Stone	5	feet

H. T. Dickinson, photo.

Bluestone quarry of Henry St. John, 1 mile east of Walton, N. Y.

H. T. Dickinson, photo.

Bluestone quarry of Frank Bond in Oxbow hollow, 3¼ miles from Walton N. Y.

H. T. Dickinson, photo.

Bluestone quarry of George Davis, 2½ miles east of Walton N. Y.

This section is taken at the point where the face is at its maximum hight. The face is 600 feet long. The system of jointing is the same as in Ulster county, and regular. The stone is medium fine grained, of light blue color with greenish tinge, and free from reeds. The lifts vary in thickness from 1″ to 7″ and are smooth and even. The bed dips slightly to the south and east. The stone is rather soft and is suitable for mill work. The product is chiefly flag and large rock, which is sold by Deyo & Son directly to dealers in Weehawken and local dealers.

The stone is shipped from the Merrickville station of the Ontario and Western railroad at a cost of $1.75 a ton to Weehawken. Four men are employed during the quarrying season of eight to nine months. The quarry has been open seven years.

In the vicinity of Walton the following quarries are in operation.

George Davis, Walton. Quarry is on west side of Marvin hollow, 2½ miles east of Walton. The bed of stone is 10 to 12 feet thick, with 14 feet of rock and 3 feet of soil overburden. The bed is horizontal and with even lifts, which vary from 1″ to 11″ in thickness. The vertical joints are rough and irregular. The stone is of medium grain and gray blue, when not discolored from sap near the joints. Some reeds are present, which are used in splitting the stone. The product includes flag edge stone and rock, which is sold to dealers at Weehawken. 50 to 60 cars a year are shipped during the season. Three men are employed. A hand derrick is in use.

Frank Bond, Walton. Quarry is situated in Oxbow hollow on the eastern side, 4½ miles east of Walton. The quarry is on ledge showing bed of stone 8 to 10 feet thick, with 25 to 35 feet of rock and 5 feet of earth top. The stone is light blue, fine grained and even bedded, with lifts varying from 2″ to 7″. Side seams are prominent, but not exactly vertical. The headers are few. The bed is horizontal. The product is flag and platform, and is shipped at Colchester Station on the Delhi branch of the Ontario and Western railroad. A hand derrick is part of the equipment. Two to three men are employed.

Ralph Cairns, Walton. Quarry is situated on south side of west branch of Delaware river, 1½ miles east of Colchester Station. This quarry was operated for a number of years and abandoned. Cairns began operations last year. The ledge has been opened up for 900 feet in an east and west direction. The face shows a maximum hight of 55 feet, 30 feet of shale and rock at the top. Bed of stone 8 to 10 feet, 2 to 3 feet of shale, and bottom bed of stone 10 to 11 feet thick. The characteristics of the stone vary with its position in the bed. At the eastern end of the quarry the top bed is red and thin bedded, while at western end the stone from the top bed is blue and the lifts are thicker. The lower bed is fairly regular throughout in regard to color and grain, but the stone from it in the eastern end has few reeds and is hard to split, while at the western end the stone is reedy and splits easily and well.

The western end of the quarry has not been opened up as deeply as the eastern end. The bluestone has a greenish tinge and is of medium fine grain. The lifts vary from 2″ to 22″. The product includes flag, edge stone and rock, which is shipped at Colchester Station on the Ontario and Western railroad (Delhi branch). The quarry is equipped with two hand derricks. Three men are employed.

William Cairns, Walton. Quarry situated on south side of West branch of Delaware river, 2½ miles east of Walton, in same range as Ralph Cairns's quarry. The bed of stone is 9 feet thick, with 22 to 23 feet of rock stripping. The dip is a gentle one to the west. The face has a length of 500 feet. The two systems of vertical jointing are well developed. The stone is medium fine grained, light blue and somewhat reedy. The product is shipped at Colchester Station. The cost of cartage is 90c a load. 25 cars were shipped during the past season. The quarry is equipped with a hand derrick, and four men are employed.

J. Merritt, Hamden. Quarry is 2 miles south of Hamden on hillside. It is small and is worked intermittently only. The bed of stone is 8 to 9 feet thick, with 6 feet of rock and 12 to 15

H. T. Dickinson, photo.

Bluestone quarry of J. Merritt, 2 miles south of Hamden N. Y.

H. T. Dickinson, photo.

Bluestone quarry of L. J. Moore, Pine creek south of Walton, N. Y.

H. T. Dickinson, photo.

Bluestone quarry of W. G. Underwood on N. Y. O. & W. R. R. between Cadosia and Rock Rift N. Y. This is a new opening and shows a 3 foot bed of clay between two beds of stone

feet of dirt top. The bed is irregular and horizontal. It is divided by irregular vertical joints. The stone is fine grained and gray blue. The product is shipped at Hamden on the Ontario and Western railroad (Delhi branch).

A small quarry has been opened at Delhi for the local market. It is worked intermittently only.

I. J. Moore, Pineville. Quarry in Pine brook hollow 3 miles west of Walton. The stripping of rock and clay is 4 to 15 feet thick, and covers a bed of stone which is coarse grained and bluish gray, 5 feet thick. The lifts vary from 2″ to 6″, the lower ones being quite rough. The vertical jointing is quite irregular. The stone is shipped at Pine switch on the Ontario and Western railroad to Schenectady. Three to four men are employed.

Ellsworth Huntington, Rock Rift. Quarry is situated above Draper's switch 2 miles north of Apex. The ledge has been opened around the hill for 300 feet. The bed of workable stone is 12 feet thick, with 12 to 14 feet of rock top. The stone is greenish gray and coarse grained. The bed is divided by the usual joints, which are regular and smooth. It dips to the northeast 14 inches in 20 feet. The lifts vary from 2″ to 12″. The product includes flag, curb, steps, etc. 30 to 40 cars are shipped each year to various points. Three to four men are employed.

T. Slossenburg, Hancock. Quarry is just west of Kerry switch, 4 miles north of Cadosia on Ontario and Western railroad. The quarry is small and not worked regularly. The bed exposed is 4 feet thick, with 12 feet of rock stripping. The stone is thin bedded, coarse grained and of gray color. The bed dips gently to the west. The face along the side seam is 75 feet long. Flag is the product, and is shipped at Kerry switch by way of the Ontario and Western railroad.

W. G. Underwood, Hancock. This quarry is just south of and on ledge below Slossenburg's. The quarry is just being opened and shows 2 beds of stone, 2 and 6 feet thick, separated by a stratum of earth 3 feet thick. The probable explanation of this is that the top bed has been broken off the main ledge and

shoved outward on the drift earth above the lower bed. The stone is greenish gray and coarse grained. The product is chiefly flag, which is carted to Kerry switch. Four men are employed.

Peter Fritz, Hancock. Quarry is ¾ of a mile northwest of Cadosia on west side of valley. The bed of stone of 20 feet has a rock and clay top 30 to 35 feet thick. The stone is of medium grain and reedy. The face is 250 feet long in the direction of the side seams, which are irregular. The lifts vary from 4″ to 12″. The bed dips to the west. The product of flag and edge stone is sold to Kirkpatrick at Hancock.

E. J. Cotter, Hancock. Quarry situated 2 miles east of Hancock on north side of East branch of Delaware river. The quarry is rated as being one of the best in the district. The product is nearly all sold as rock to mills at different places near New York. It is shipped by the Ontario and Western railroad from Gravel bank switch. 65 to 70 carloads are shipped each year. The bed of stone is 17 feet thick, with rock top of 35 to 50 feet. The bed is divided by the regular jointing systems. The side seams are regular, but the headers are not. The lifts vary from 2″ to 4″, depending on the block. The stone is bluish gray except where stained with sap, where it is greenish gray. The grain is medium fine. The quarry is equipped with hand derrick. Six to 10 men are employed.

Roy Wheeler, Hancock. Quarry is 2 miles east of Cadosia on south side of East branch of Delaware river. The top is 10 to 15 feet thick and of thin bedded rock. The bed is 6 feet thick and dips to the south gently. The lifts are 1½″ to 3″ thick and very even and smooth. The side seams are uniform, but the headers are irregular. The ledge has been opened up 200 feet along the line of the headers. The stone is coarse grained and greenish blue gray. Flag is the main product, and is sold at the Tunnel switch on the Ontario and Western railroad to Randall Bros. Three men are employed.

Leahey Bros., Hancock. Quarry 3 miles east of Cadosia, 15 feet above the East branch of Delaware river. The quality of

the stone is very fair. It is grayish blue and fine grained. The bed is 25 feet thick, with 45 feet of rock top. The bed is horizontal and at east end of quarry is very rough. The side seams are regular, but head-offs are not. The lifts vary from 2″ to 20″. Some reeds are present. The product is chiefly flag, and is hauled to Tunnel switch on the Ontario and Western railroad, where it is sold to Randall Bros. 20% of the value of each load is paid for cartage. Two men are employed.

James Nevins & Sons, Fish Eddy. This firm has a mill at Tyler's switch between Fish Eddy and Hancock, where it saws, planes and rubs the product of its quarry, which is 1 mile northwest of the mill on the hillside. The mill is equipped with three gang saws, two diamond saws, two planers, and two rubbing beds. Three derricks (two fitted for steam power) are in use. 10 men are employed nine months in the year in the mill. 50 cars a year of dressed stone are shipped, principally to New York. The apartment house in New York on 10th avenue, between 57th and 58th streets, is an example of the construction of this stone. The chief product of the mill is finely dressed house trimmings, steps and platforms. The mill was formerly near Walton. The quarry is operated by contract by Irving Carver, who is paid 2½c an inch thick per square foot for rock quarried, and 45c a cubic yard for stripping. The bed of stone is 16 feet thick, with 30 to 35 feet of rock stripping. The stone is of medium grain, gray blue color and rather soft. The bed is horizontal, and divided by irregular vertical joints. Black jack occurs in the bed in spots. The quarry is equipped with hand derrick, steam boiler and drill. Three to four men are employed.

Christopher Proskine, Fish Eddy. Quarry is situated 1½ miles east of Fish Eddy. The opening is very small and shows 4 feet of bed, with 10 to 12 feet of rock top. Cross bedding appears in the ledge, causing waste. The stone is coarse grained and blue gray, and is quarried for flagging. The stone is hauled to Fish Eddy and shipped by the Ontario and Western railroad.

G. W. Swartwout, Read Creek. Quarry situated on hillside on west side of Delaware river (East Branch), 2 miles north of Fish Eddy. The ledge has been opened 250 feet in the direction of the side seams, which are irregular. The bed of stone is 4 to 5 feet thick, with rock top of 20 feet. The stone is coarse grained and gray blue. Much of it is stained with sap. The bed dips to the south and west. The lifts are 2″ to 2½″ thick, producing flag chiefly, which is shipped at Fish Eddy. Two to three men are employed intermittently.

Sydney Skinner, East Branch. This quarry is on hill across the river from Swartwout's. The quarry is very small and is just being opened. 3 feet of bed are exposed, with 6″ of shale and 6″ of clay top. The bed is horizontal, and the seams are 2″ to 3″ apart. The stone is of medium coarse grain and greenish gray color. Below the bed a rough streak occurs. The product of flag is hauled to East Branch and sold to Rhodes.

This is as far south on the line of the Ontario and Western railroad as the quarries were visited. A few other quarries are being worked near East Branch.

As before remarked, there are a number of quarries at Deposit that were not seen. The description of those that were visited follows.

S. F. Whittaker & Co., Deposit. Quarry is 2½ miles south of Deposit on west side of Delaware river in Broome county. The face along the side seams is 600 feet long and at the maximum hight is 35 feet, of which 7 feet are workable stone. The stripping of 12 to 28 feet is rock, shale and earth. The stone is of medium grain and rather dark blue color. Some reeds are present. The bed dips to the southwest at a noticeable angle. The product is sold to Deposit stone co. Three to four men are employed during the season.

Charles Linkroum, Deposit. Quarry 4½ miles south of Deposit near Pennsylvania state line. The bed of stone exposed is 13 feet thick, with top 12 to 35 feet thick of rock, shale and earth. The bed is horizontal. The lifts vary from 1½″ to 8″. The grain of the stone varies from the top down. The stone from

the upper lifts is coarse grained, while in the lower lifts the stone is finer grained and reedy. The color is fairly good blue throughout. The side seams are fairly regular, but as usual the heads are rough and uneven. The product includes flag and edge stone, which is sold to Travis & Kingsbury at Hale Eddy. Four men are employed.

Kinney & Lee, Hale Eddy. This quarry is just above Linkroum's and is a new opening. 12 feet of bed are workable, above which are 8 feet of rock and 6 feet of dirt. The lifts are nearly all thin, 1″ to 2″, and the product is chiefly flag. The stone is rather fine grained and when not discolored by sap is of good blue color. The bed is horizontal and is divided by vertical joints of the usual direction. The east and west joints are very irregular. Travis & Kingsbury at Hale Eddy buy the stone. The cost of cartage is 10% of the value of the load. Four men are employed.

Curtis & Smith, Sherman Pa. Quarry lies just north of Pennsylvania line, 5 miles south of Deposit. The bed of stone is 5 feet thick, with 15 to 30 feet of shale top. The stone is fine grained and compact. It is of gray blue color, except where discolored by sap. The bed is horizontal, and the seams 3″ to 8″ apart. The face of the quarry is east and west, 200 feet long. Both systems of vertical jointing are present. The product is chiefly flag and edge stone, which is sold at Hale Eddy to Travis & Kingsbury. Three men are employed.

Hobbs & Tupper, Hale Eddy. These men work on same ledge as Curtis & Smith. Two men are employed. Both quarries are in Broome county.

John F. Sprague, Oquaga Lake. Quarry is 1½ miles southeast of Oquaga Lake. The quarry has been open for a number of years and was worked extensively for a time. The scale of operations is now small, and the main ledge is not worked. Some outside blocks are being worked into flag. The bed of stone in main ledge is 8 feet thick, with 12 to 20 feet of rock top. The stone is uniformly coarse grained and gray. The vertical joints are well developed and straight. The lifts run quite

heavy in the main ledge, 6″ to 10″. The stone is free from reeds. The bed is horizontal. The outside blocks are thin bedded and produce flag 1″ to 2″ thick, which is as smooth as a board. It is the intention of the owner to put in a derrick, strip the main ledge, and quarry stone on a somewhat larger scale. The product is sold at Hale Eddy and Deposit.

Andrew Weyman, Deposit. Quarry 1 mile south of Oquaga Lake. The quarry is very small. The bed of stone is 5 feet thick, with 8 feet of shaly top. The stone is thin bedded, gray and coarse grained. The product, which is flag, is hauled to Hale Eddy. It is worked only intermittently.

Riley Shellman, Deposit. Quarry is situated on Sand pond hill, 2½ miles south of Deposit, in Broome county. The bed of stone is 4½ feet thick, with 15 feet of rock top, which is broken. The bed dips to the west slightly and is divided by regular vertical joints north and south. The east and west joints are uneven and rough. The stone is fine grained, compact and gray blue. Near the joints the stone is discolored by sap. The lifts vary from 1½″ to 4″ in thickness. Few reeds are present. The ledge has been opened 250 feet along the side seams. The product of flag and curb is sold at Deposit to Deposit stone co. Three men are employed.

P. J. Madden, Deposit. Quarry is situated in Broome county south of McClure postoffice on hill south of Erie railroad. This is quite an extensive quarry, and is worked on a larger scale than usual in the district. The bed of stone is 12 feet thick and has an overburden of red shale 25 feet thick. The red shale is not often found in this vicinity. Just below the shale and above the bed is a stratum of rock 4 feet thick, which has a greenish tinge. The north and south vertical joints, or side seams, are regular and smooth, but the other system of vertical jointing is very irregular. The ledge has been opened around the hill 150 feet. The lifts vary from 6″ to 20″ in thickness, but are reedy and can be split into 2″ flag if necessary. The stone is fine grained, compact and a light gray blue. The quarry is favorably situated near the Sand bank switch on the Erie,

H. T. Dickinson, photo.

Bluestone quarry of Conrow and Hauyck, north of Deposit, showing "black jack"

where Mr Madden has a loading dock. The product includes all varieties of stone. Six to 10 men are employed the year round. The quarry is equipped with a hand power derrick.

Patrick McAvoy, Deposit. Quarry situated on Shaeffer hill 2½ miles north of Deposit. The quarry is very small, showing 4 feet of thin bedded, coarse grained stone. The bed dips to the northeast rather sharply and is covered with a top of thin bedded rock 12 to 15 feet thick. The vertical jointing is very irregular. The product is chiefly flag, which is sold at Deposit to Kirkpatrick Bros.

John W. Scott, Deposit. Quarry 2½ miles northeast of Deposit on Rooney hill. The bed is horizontal and 9 feet thick at the maximum. The top is of red rock 10 to 15 feet thick, some of which is worked into salable stone. The seams are 6″ to 8″ apart. The face of the quarry runs 125 feet north and south. The stone is fine grained, light gray blue and very dense. The product is chiefly edge stone, which is sold to Kirkpatrick Bros. at Deposit. Two men are employed.

Conrow & Hauyck, Deposit. This firm is quarrying on the northern end of the ledge where Scott is quarrying. Here black jack occurs, which has eaten the bed down to 4½ feet. The black jack is lens-shaped, soft and crumbles in the hand. Two men are employed.

F. D. Walley, Deposit. Quarry is 2 miles north of Deposit on west side of Delaware river. The bed of stone is 10 feet thick, with a 2 foot streak of rough rock 3 feet below the top of bed. The stone below the rough streak is of better quality than above it. The bed pitches to the south and west gently. The stripping consists of 5 feet of rock and 13 feet of earth containing boulders. The stone is fine grained and gray blue. The side seams are regular, but the headers are very rough. The lifts vary from 2″ to 8″. The product is sold to Kirkpatrick Bros. at Deposit. Two men are employed.

George Shellman, Deposit. Quarry 5½ miles from Deposit on west side of Delaware river. The bed of stone is 6½ feet thick, with a top (varying from 7 to 15 feet in thickness) mostly of rock.

The stone is of medium grain and blue when not discolored by sap. The lifts are evenly bedded and range from 3″ to 6″ in thickness. The bed is horizontal. The side seams are regular and smooth, but no heads are to be seen. The stone is sold to Kirkpatrick Bros. at Deposit. Two to three men are employed.

Shellman & Warner, Deposit. This firm is just opening a quarry north of Walley's quarry. Three to four men are employed.

Near Hale Eddy the following quarries are in active operation.

Ostram & Freeman, Hale Eddy. Quarry is situated 1 mile north of Hale Eddy. The bed of stone is 6½ feet thick, with 12 feet of top, 4 feet of which are earth and the balance rock. The stone is badly stained with sap and has only occasional streaks of blue. It is fine grained and dense. The top rock is very hard and can be drilled only with difficulty. The seams are irregular, having a tendency to shift and grow, causing a large amount of waste. 10% of the value of each load is paid for cartage to Hale Eddy, where the stone is sold to Travis & Kingsbury.

G. N. Lord, Hale Eddy. Quarry is in Broome county, ¾ of a mile east of Hale Eddy on south side of Delaware river. The bed of stone is 7 feet thick, with 11 to 13 feet of rock top and 4 feet of earth. The stone is fine grained and of a good blue. Near the joints it is stained with sap. The bed dips to the southeast. The side seams are quite regular and smooth. The lifts vary from 3″ to 6″. The product is chiefly flag and edge stone, which is sold at Hale Eddy to Travis & Kingsbury. One man is employed.

Jones & Adams, Hale Eddy. This quarry is ¼ of a mile east of Lord's and in the same range. The bed of stone is 7 feet thick, covered with 12 to 25 feet of rock and earth. The face of quarry extends east and west 150 feet. The north and south joints are straight and even, while the east and west joints are very irregular. The bed is horizontal, with seams 2″ to 6″ apart. The seams are quite apt to shift and grow. The stone is sold at Hale Eddy to Travis & Kingsbury. Three men are employed.

On both sides of Rood and Sands creeks, which flow southward into the Delaware, quarries have been opened. Those in active operation follow.

Arthur Beagle, Hale Eddy. Quarry on western side of the west branch of Rood creek, 2 miles from Erie railroad. The ledge has been opened up 500 feet long in a north and south direction. At its maximum hight the face is 50 feet, of which 16 feet are stone, the balance being rock (in which some shale occurs) and earth. The bed dips slightly to the south and west. The side seams and heads are quite regular, the average area of a block being 2000 square feet. The bed of stone has been shown to be 25 feet thick, but, owing to the tightness of the lifts at the bottom, the stone can not be quarried. The stone is rather coarse grained, of fairly good blue colcr (specially the lower lifts) and reedy. It is maintained that these reeds will not open. The lifts vary in thickness from 2″ to 6″. The product consists of flag and edge stone, which is sold to Travis & Kingsbury. Three men are employed.

Beagle & Mayo, Hale Eddy. This firm is quarrying on the same ledge as Arthur Beagle. Its product is sold to Kirkpatrick Bros. at Rood creek switch on the Erie railroad. A hand power derrick is in use. Three men are employed.

Patrick Griffen, Hale Eddy. Quarry is on west side of eastern branch of Rood creek. The ledge is covered with 2 feet of earth; then come in succession 4 feet of rock, 6 feet of stone, 4 feet of shale and rough stone, and at the bottom 2½ feet of stone. The bed dips to the south and east. The two systems of vertical jointing are present. The stone is coarse grained and has a greenish blue appearance. The product of flag is sold to Travis & Kingsbury at Rood creek switch. Two to three men are employed.

Van Aken & Minko, Hale Eddy. Two men are employed in quarrying on same ledge as Griffen.

Richard Kennedy, Hancock. Quarry situated on eastern side of Rood creek 2½ miles north of Erie railroad. The bed of stone here is 9 feet thick, with top ranging from 10 to 25 feet of rock.

The stone is coarse grained and greenish gray blue in color. The face of the quarry is 450 feet long in an east and west direction. The bed was 15 feet thick in the early history of the quarry, but "the bottom has pitched up and pinched it out." The vertical joints are irregular, as is the dip. The product is hauled 3 miles to Hale Eddy at a cost of 20% of the value of the load. It is sold to both local dealers. Two men are employed.

Shaefer Bros., Hancock. This quarry, on eastern side of Rood creek and 3 miles from Erie railroad, is said to be one of the best quarries in this vicinity. The quarry face is 800 feet long in an east and west direction. The dip of the strata is to the east, where the water collects and is drained by a ditch. The bed of stone averages 14 feet in thickness. Overlying it are 3 feet of rock and 10 to 20 feet of earth. The vertical jointing is not uniform, but has the usual direction. The lifts vary from 4″ to 44″ in thickness. The stone is medium fine grain and of fair blue gray color. The product is chiefly rock, but some edge stone is cut. The quarry is equipped with hand power derrick. Six men are employed during the year.

Thomas Roche, Hancock. Two men are employed quarrying on Shaefer's ledge west of the opening. The stone is all hauled to Rood creek switch on the Erie railroad and sold to both local dealers.

Elmer Beagle, Hancock. Quarry on west side of Rood creek, 3½ miles from Erie railroad. This quarry face shows but 4½ feet of bed, with 20 to 25 feet of interbedded rock and shale. The stone is coarse grained. The top lifts are gray and the bottom are gray blue. Black jack occurs here and has eaten out 3 feet of the bed, which was 8 feet thick when the quarry was first opened. The vertical seams are irregular. The bed dips slightly to the west. The product is chiefly flag, which is sold at Rood creek switch to Travis & Kingsbury. The cost of cartage is 20% of the value of the load of stone. Two men are employed.

Bert Lee, Hancock. Quarry is situated on the hill on the west side of Rood creek and on the north side of the Delaware river.

The opening is not large, showing 6 feet of bed with 12 to 15 feet of rock top. The stone is thin bedded, medium coarse grained and grayish blue in color. The vertical joints are irregular in direction. The seams are 1½″ to 4″ apart, and some are rough. The bed has a slight pitch to the west. The product of flag is sold to Kirkpatrick Bros. at Rood creek switch. Two men are employed.

Travis & Kingsbury, Hancock. This is a firm of buyers and quarrymen. The quarry is on north side of Delaware river, 4½ miles northwest of Hancock. The opening is an old one and is 1200 feet long in an east and west direction. The western end only is being worked. There are two beds of workable stone. The top bed, 7 feet thick, is separated from the lower bed, 5 feet thick, by a rough streak 5 feet thick. Above the top bed there are 25 feet of rock and 1 to 2 feet of clay. The beds pitch rather more sharply than usual to the north. The stone is coarse grained and ranges in color from light blue to greenish gray. The vertical joints are quite irregular in direction. The beds at the eastern end of the opening are horizontal, which shows the variation of the dip. This is a common feature of the quarries of this district. The stone is carted to Travis & Kingsbury's yards at Rood creek switch. Seven to eight men are employed.

Robert Moore, Hancock. Quarry 5½ miles north of Hancock on west side of Sands creek hollow. The face of the ledge has been opened 300 feet east and west, and shows bed of 12 feet of stone covered with 8 to 15 feet of rock top. The seams are even and 1″ to 6″ apart. The stone is rather coarse grained and of good blue color when sap has not discolored it. The bed is horizontal. The stone is worked into flag chiefly, which is sold to Randall Bros. at Hancock. Four men are employed.

Crozier & Bahan, Hancock. This firm is opening a quarry on the Moore ledge. Two men are employed.

Fitch & Randall, Hancock. Quarry 5 miles northwest of Hancock on west side of Sands creek. The bed of stone is 7 feet thick, with 5 to 6 feet of rock and earth top. The quarry was opened this season. The stone is coarse grained and greenish

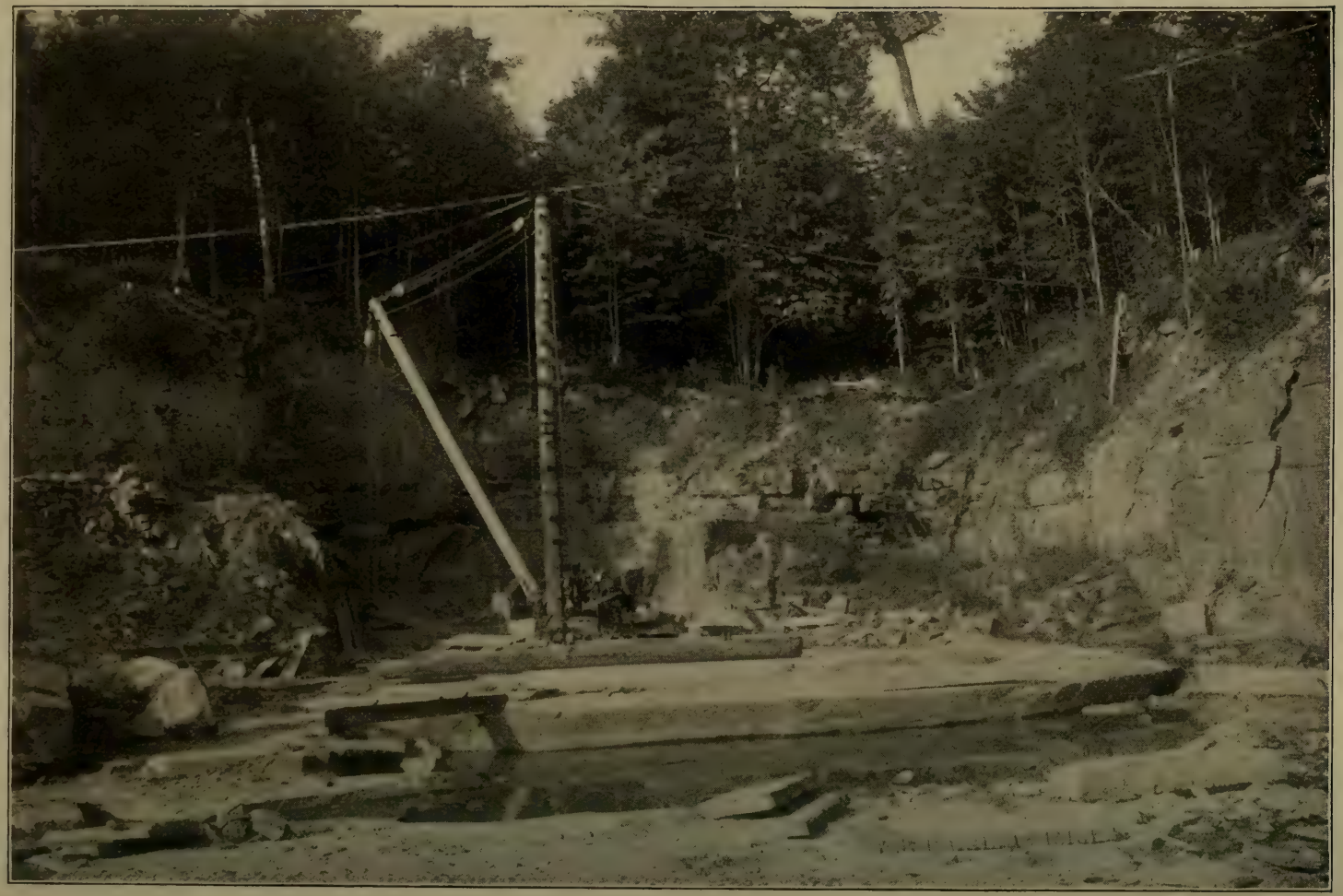
blue. The lifts vary from 1½″ to 4″. Randall Bros. at Hancock handle all the product, which is chiefly flag. Four men are employed.

Rice & Co., Hancock. Quarry is 3 miles northwest of Hancock on western side of Sands creek near the top of the hill. The ledge has been opened 300 feet north and south along the side seams. The stripping, amounting to 30 feet of rock covered with a layer of earth, covers a bed of stone 15 feet thick, with lifts varying from 6″ to 24″. The stone is coarse grained and gray blue. Sap has discolored the bed near the joints. Reeds are present and are of the type which tighten on exposure. The product is principally curb and rock, which is sold to Kirkpatrick Bros. at Sands switch on the Erie railroad. Three men are employed.

M. J. Ford, Hancock. Quarry is situated on west side of Sands creek 2½ miles northwest of Hancock. The bed of stone is 8 to 9 feet thick with 22 to 25 feet of rock, shale and earth top. The stone is coarse grained and the lower lifts are of fairly good blue color. The upper lifts are greenish gray. Some cross bedding appears in the ledge, causing waste. The vertical joints are irregular and stained with iron. The lifts vary from 1¼″ to 5″. The product includes all varieties of stone, which is sold to Randall Bros. at Hancock. Three men are employed. Cost of cartage to Hancock is 17¢ per value of load.

Patrick White, Hancock. Quarry is situated on the same hill as Ford's, but several ledges above. The bed of stone is 10 to 11 feet thick, with 20 feet of rock top. The bed dips somewhat more sharply than usual to the west. The bed is divided by joints, which are not exactly vertical, dipping slightly to the east. The stone is even bedded, the lifts varying from 2″ to 9″ in thickness. The stone is coarse grained and greenish gray blue. The product includes flag and edge stone, which is sold to G. W. Kazenstein, a small buyer at Hancock on the Scranton branch of the Ontario and Western railroad. Two men are employed.

Edward Kearney, Hancock. This quarry is just opened on a ledge above Ford's and below White's. The bed of stone worked



H. T. Dickinson, photo.

Bluestone quarry in Sands creek hollow near Hancock N. Y.

so far is 4 feet thick and covered with a rock top of 10 to 15 feet. The stone is coarse grained and light gray blue. The lifts vary from 1″ to 3″. The stone is sold to Randall Bros. at Hancock. Two men are employed six months in the year.

Johnson & Dirig, Hancock. Quarry is 3 miles northwest of Hancock on east side of Sands creek. The ledge has been opened 700 feet around the edge of the hill. The quarry has been worked extensively and is now producing a medium amount of stone. The face has a maximum hight of 52 feet, 40 feet of which are pencil and 12 feet bed. The upper 3 feet of bed are thin bedded and suitable for flagging; but the lower lifts are very heavy, with few reeds which are hard to split, the seams being 2 to 3½ feet apart. These heavy lifts are sold as rock to Kirkpatrick Bros. at Sands switch. The bed dips slightly to the south. The system of jointing is regular and smooth. 20% of the value of each load is paid for cartage. Two to four men are employed, eight months in the year.

Arnold Grimsback, Hancock. This quarry is on west side of Bear brook hollow 1 mile northwest of Hancock. This quarry, known as the Baily quarry, was at one time a great producer of stone, but is now worked at one end only. The face is 450 feet long, north and south, and shows a bed of stone ranging from 5 to 15 feet in thickness. The top is very heavy, 10 to 40 feet thick and of rock. The stone is coarse grained and of good gray blue. The lifts vary from 3 inches to 4 feet in thickness. The stone is worked into edge stone and rock. Little flag is produced, on account of the heavy lifts. The product is sold to Randolph Bros. at Hancock. One man is employed.

Hanrahan & Cahill, Hancock. This quarry is 2 miles northwest of Hancock in Bear brook hollow. The bed of stone is 8 feet thick, with 7 feet of clay and shale top. The stone is even bedded (the seam being 1½″ to 6″ apart) of medium fine grain and a dirty blue color. The product is flag and edge stone, which is sold to Kirkpatrick Bros. at Hancock. The cost of cartage is 17% of the value of each load. Two men are employed. The quarry has been opened 10 months.

P. Hanrahan, Hancock. A very small quarry situated on Coon hill 3 miles north of Hancock. The bed of stone is 4 feet thick, with 8 to 10 feet of rock and shale top. The bed is quite rough, dipping gently to the northeast. The stone is of medium grain and grayish blue, lifts varying from 2″ to 3″. The product is chiefly flag, sold to Kirkpatrick Bros. at Hancock. Two men employed.

Thomas Scully, Hancock. The quarry is situated on the point of the hill ½ mile north of Hancock. The bed is horizontal and 10 to 14 feet thick. It is covered with a top of rock 25 to 30 feet thick. The stone is of medium grain and gray blue in color. Reeds occur in the lifts, which split easily. A rough streak appears in some parts of the bed and causes waste. The two systems of vertical jointing are as usual in the district. The north and south joints are the more regular. The lifts vary in thickness from 3″ to 12″. It is said that quarrying can be carried on all the year without affecting the stability of the stone. The face of the quarry is 250 feet long. The product consisting of rock, edge stone, and some flag, is bought by Kirkpatrick Bros. at Hancock. The quarry is equipped with hand power derrick. Four men are employed.

O'Rourke & Stewart. Quarry is situated near Women pond 6 miles east of Hancock. The bed averages 6 feet in thickness and is covered by thin bedded rock 12 to 15 feet thick. The bed dips to the southwest at a noticeable angle. Cross bedding appears in the top. The stone is coarse grained and a bluish gray, and flag is the chief product. The vertical jointing is irregular. The product is chiefly flag, which is carted to Stockport and sold to Kirkpatrick Bros. Two to three men are employed.

Comfort & Wood, Hancock. Quarry is 1 mile west of O'Rourke & Stewart's. The bed of stone is 6 feet thick and covered with 12 to 14 feet of rock and clay. The opening is not large. The north and south vertical joints are well developed and regular, but the east and west joints are not uniform. The stone is coarse grained and gray blue. The product is sold to Kirkpatrick Bros. at Stockport.

Between Stockport and Lordville there are three quarries in operation: two of Henry Prigge's and one of John Cuddike's. The product from these quarries is shipped by the Erie railroad at Kilgore's switch. One of Prigge's quarries is situated on hillside north of Delaware river and ½ mile northeast of Kilgore's switch. The thickness of the workable bed averages 6 feet and is of even, thin bedded, grayish, fine grained stone, which is reedy. The stripping consists of 2 feet of rock and 10 to 35 feet of earth containing boulders. The bed dips slightly to the northwest. The vertical joints are irregular and curved. The lifts vary in thickness from 2″ to 4″. The product is chiefly flag. Three to four men are employed.

The other quarry of Prigge's is on the same hill as the above, but on the western side. The bed of stone dips to the west and is 10 feet thick. There is a rough streak 3 feet thick in the middle of the bed, all of which is waste. The top is 40 to 45 feet thick, 10 feet of which are red clay, the balance being thin, irregular bedded rock. The stone is fine grained, gray blue and reedy. It is said that these reeds will not open by weathering. Four to five men are employed.

John Cuddike, Lordville. Quarry situated 1 mile north of Kilgore's switch on west side of hollow. The opening is small, but interesting on account of the lens of black jack which occurs in the top, which is of shale and rock and 16 feet thick. The stone is of medium grain and is gray blue. The even bedded lifts are 4″ to 8″ thick. The thickness of the workable stone is 4½ feet. Two men are employed.

List of docks and stone buyers along Erie and Ontario and Western railroads

Kirkpatrick Bros. Hancock

Erie. Deposit: 125 cars a year (estimated), three men employed.

Rood creek switch: 150 cars a year, three men employed.

Hancock: 200 cars a year, four to five men employed.

Stockport: 40 to 50 (20 ton) cars a year.

Lordville: 300 (20 ton) cars in 1899, four employees.

O. & W. Tyler's switch: 40 to 50 cars a year.

Travis & Kingsbury, Hale Eddy

Erie. Hale Eddy: 250 cars a year, two to three men, hand derrick.

Rood creek switch: 450 (20 ton) cars a year, two to four men employed, hand derrick.

Randall Bros. Hancock

O. & W. Tunnel switch: 50 cars a year.

Erie. Hancock: 250 cars a year, two men employed.

Deposit stone co. Deposit

Erie. Deposit: 200 (20 ton) cars a year, two men employed loading.

Sand bank switch: 25 cars a year, two men employed loading.

Sands creek switch: 125 (20 ton) cars a year, three men employed.

P. J. Madden, Deposit

Erie. Sand bank switch: 150 to 200 cars a year.

Henry Prigge, Lordville

Erie. Kilgore's switch: 40 to 50 cars a year, two men employed.

Standard bluestone co. Jersey City

Erie. Lordville: 196 (20 ton) cars a year, two yardmen.

G.W. Kazenstein, Hancock

O. & W. Hancock: 125 cars a year.

Average value of carload of stone of 20 tons is $90.

During 1900 the cost of freight from above docks to markets in Jersey City was $1.55 a ton, in New York $2.15 a ton and in Philadelphia $2 a ton.

QUARRIES IN THE SOUTHCENTRAL COUNTIES

Oneonta, Otsego co.

Bluestone quarry of Olds & Miller, situated north of West Davenport, 5 miles east of Oneonta. A very fine quality of hand dressed stone is produced. The stone is of good blue color and fine grained, and takes tooling nicely. The bed of stone is 8 feet thick with 8 to 9 feet of stripping of rock and clay. The lifts vary from 4″ to 8″ and are smooth. The product includes flag and all varieties of edge stone. The market

Quarry of F. G. Clarke bluestone co. Oxford N. Y.

is chiefly in Oneonta and other towns along the Delaware & Hudson railroad.

Several other small quarries have been opened near Oneonta for common building stone, but are worked only at irregular intervals.

Oxford, Chenango co.

The largest quarry of bluestone in New York is situated northwest of Oxford on the west side of the Chenango valley, 150 feet above the railroad. The quarry was first opened in 1874 and operated in a small way till 1880, when F. G. Clarke (later F. G. Clarke & Son and F. G. Clarke bluestone co.) took hold and began quarrying on a large scale. The bed of stone has a total thickness of 18 feet, and the stripping, or overburden, consists of 40 feet of drift earth, in which are imbedded large boulders and 25 feet of solid rock. The top 10 feet of bed is divided by horizontal seams 4″ and upward apart. The stone from this bed is used chiefly for platforms. The bottom 8 feet is of two lifts 4 feet thick, and known as "liver" rock. Liver rock is very dark blue and can be worked equally well in all directions; and is used chiefly for house trimmings and building stone. The stone is a good blue, fine grained and softer than the Ulster county stone. The following tests and analyses are interesting.

Stone from the quarries of the F. G. Clarke bluestone co.

TESTS MADE AT THE NEW YORK STATE MUSEUM, UNDER THE DIRECTION OF PROF. J. C. SMOCK

Specific gravity	2.7113
Weight, per cubic foot	168.97
Percentage of water absorbed	1.11
Weight of water per cubic foot	1.876
Percentage of gain in weight in CO_2 gas	.0024
Weight increased in lb (per cubic ft)	.0041
Percentage of gain in sulfurous acid	.064
Weight increased per cubic ft	.108
Freezing and thawing test	No effect

CRUSHING TEST MADE UNDER THE SUPERVISION OF THE ASSISTANT ENGINEER EMPLOYED IN TESTING MATERIAL FOR THE PEDESTAL OF THE STATUE OF "LIBERTY ENLIGHTENING THE WORLD," AP. 20, 1884

Dimensions

1st cube, 3 in. x 2.936 in. x 2.786 in. = 8.18 sq. in.
2d " 3 in. x 2.77 in. x 2.776 in. = 7.699 "
3d " 3 in. x 2.888 in. x 2.802 in. = 8.092 "

No. 1 bore a strain of 103,700 lb before crushing on its quarry bed

No. 2 bore a strain of 103,600 lb before crushing on its quarry bed

No. 3 bore a strain of 98,340 lb before crushing not on its quarry bed

The 1st stood a strain of 12,677 lb to the sq. in.
" 2d " 13,472 "
" 3d " 12,152.7 "

ANALYSIS MADE BY W. E. GIFFORD, CHEMIST, 54 PINE ST. NEW YORK

Silica	77.56
Alumina	10.65
Oxid of iron	4.59
Oxid of manganese	.09
Lime	.34
Magnesia	1.22
Potassa	2.15
Soda	.9
Water	1.93
Undetermined matter and loss	.57
	100

The strata are horizontal and the situation of the quarry is such that the drainage is natural. The quarry face is 1000 feet long in a north and south direction and is being worked at various points. The stripping is carried on during the winter season and is done by blasting. The earth is carted away by wagon, and the rock is piled up east of the face by the derrick.

A wire tramway was in use for stripping, but has been found to be of little advantage. The bed of stone is blasted out, holes being bored by steam drills and reamed out according to the Knox system. A channeling machine was formerly used. The quarry is equipped with three steam power derricks. A mill equipped with planers, gang saws and rubbing bed is run in connection with the quarry. Here the stone is prepared for the various demands of the market. 100 men are employed in quarrying and dressing the stone. 1000 carloads have been shipped this year by the Ontario and Western railroad to various points. The market is chiefly in New York and Pennsylvania towns. A special car capable of carrying a stone 25 feet x 15 feet is used by the company in shipping the largest stone.

Examples of construction in which the Oxford bluestone has been used are, the lower portions of Aldrich court, 41-43 Broadway, New York; the steps in the terrace approaching the capitol at Washington; the steps, platforms and column bases of the capitol at Trenton N. J.; St Lawrence hall, New Haven Ct.; the state prison for insane criminals at Matteawan N. Y.; the Oxford bank building at Oxford; and the Trinity Memorial church at Binghamton N. Y.

South Oxford, Chenango co.

F. G. Clarke bluestone co. operates a quarry 1 mile east of the railroad. The face is 600 feet long in a north and south direction. A top bed of 4 feet is quarried mainly for flagging. It is covered with a top of 4 feet of clay. Underneath the bed of flag is shale 15 feet thick, covering the liver rock 9 feet thick. The same system of quarrying is in use as at Oxford. The quarry is equipped with hand derricks and drills. The flag is shipped from Coventry Station by the railroad, but the liver rock is sent to Oxford for mill treatment. 50 men are employed throughout the year.

Several small quarries have been opened in the vicinity of South Oxford for flagging at Tyner, Walker's Corners and Springfield Flats.

King's Ferry, Cayuga co.

Quarry of Cusick & Murray is ½ mile south of King's Ferry. This quarry has been opened 10 years, and produces flagging, curb and cross walks for the towns of Elmira, Waverly, Auburn, Ithaca, and others in New York state. The stone is dark blue, fine grained and easily split to a thickness of 2″. Very little dressing is done except for the curb and cross walks. The product is hauled to King's Ferry station and shipped by the Lehigh Valley railroad. The face of the quarry is 800 feet long in a northwest and southeast direction. The bed of stone is 22″ thick and divided by two systems of vertical jointing running northeast and southwest, and northwest and southeast. The vertical joints are from 2 to 60 feet apart. The bed is covered with 14 feet of dirt and 6 feet of shale. Stripping is done by blasting and handled by carts and wagons. In the shale top at the southern end of the quarry a 5″ stratum of stone occurs 14″ above the top of the main bed. The equipment of quarry includes two derricks (one hand power, one steam power) and a blacksmith shop. 20 men are employed the year round. The output averages 200 cars a year.

The prices obtained f. o. b. King's Ferry are, 9c to 15c a square foot for flag according to size and thickness; 25c to 30c a linear foot for 20″ curb; rock, 3c to 4c an inch per square foot.

Goodyears, Cayuga co.

J. G. Barger quarries flagging and building stone on a small scale here. The quarry was worked very little during the summer of 1900.

Trumansburg, Tompkins co.

Cusick & Murray are operating a quarry near Halseyville 2 miles west of Trumansburg on south side of Taughannock creek. The product is chiefly flagging, and is sold at the same points as the stone from the King's Ferry quarry. Three beds are being worked, separated by beds of shale. 15 to 18 feet of soil and 4 feet of shale cover the top bed, which is 4 feet thick. Between the top and middle bed which is 2 feet thick are 6 feet of shale. Then come 4 feet more of shale and a bed of stone 2 feet thick.

H. T. Dickinson, photo.

Bluestone quarry of J. T. Hunt, 6 miles north of Trumansburg N. Y., 1 mile west of Lake Cayuga

The face of the quarry runs north and south, and is 500 feet long. The jointing is north and south. Drainage is natural. The stone is a very dark blue, fine grained and easily split. A hand power derrick and steam drill are part of the equipment. Five to six men are employed during the year. The stone is shipped from Taughannock Falls station on the Lehigh Valley railroad.

On both sides of Taughannock creek, just below the falls, flagstone is being quarried by two operators, F. C. Biggs employing two to three men, and Peter O'Hara employing six to seven men. The bed worked is 3 to 4 feet thick and covered with 6 to 10 feet of soil. The stone is dark blue, fine grained and reedy. The lifts vary from 6 inches to 1 foot, but can be split easily to 2″. Drilling is done by "jumper" drills, otherwise the quarrying is the same as in Ulster county. The product is shipped at Taughannock Falls by the Lehigh Valley railroad to Syracuse, Rochester, Ithaca and Sayre Pa. Each operator has a hand derrick.

Several quarries ¾ of a mile west of the shore of Cayuga lake have been opened, but have not been worked in late years.

J. T. Hunt of Farmer operates a small quarry 6 miles from Trumansburg and 1 mile west of Cayuga lake. The product is flag of a reddish tinge and is quarried for local uses.

Ithaca, Tompkins co.

Sandstone of the Portage horizon is quarried 1½ miles south of Ithaca on the hillside above and below the Delaware, Lackawanna and Western railroad track. The stone is used for flagging, common building stone, and is crushed for road metal. The stone is a dark bluish gray and fine grained. The beds vary from 10 to 16 feet in thickness and have occasional streaks of shale in them. The stripping of earth is 6 to 20 feet thick. The stone is thin bedded, the distance between the seams averaging 2″. The two quarries produce road metal and are equipped with steam crushers and drills.

Wilbur J. Bates operates a quarry on the hill in the southern part of the town intermittently. The bed is 35 feet thick, a great deal of which is waste. The lifts vary from 2″ to 10″ in thick-

ness, and in the lower part of the bed are very uneven. The stone is very dark with a slight reddish tinge, and fine grained. The vertical joints dip slightly to the east and run north and south. The dip of the bed is at a gentle angle to the south. The product is used for road metal and foundations. Some trimmings are cut, such as sills and lintels. The quarry is equipped with a crusher.

"Sandstone" for the Cornell university buildings was quarried on the site of Cascadilla hall and at a quarry in front of the main building, but lower on the hillside. Another quarry was opened near the McGraw-Fiske mansion and Fall creek. The stone in Cascadilla hall is the best from these local quarries.

A quarry on E. State street is operated by Driscoll Bros. (contractors). Stone is quarried as needed. The bed of stone is 22 feet thick, with 18 to 20 feet of top. The vertical joints run east and west, and are smooth and regular, 6 to 10 feet apart. Lifts vary from 2″ to 4″. The stone is fine grained, dark colored and of red and green tinges. The product is used locally for trimmings and foundation work.

Penn Yan, Yates co.

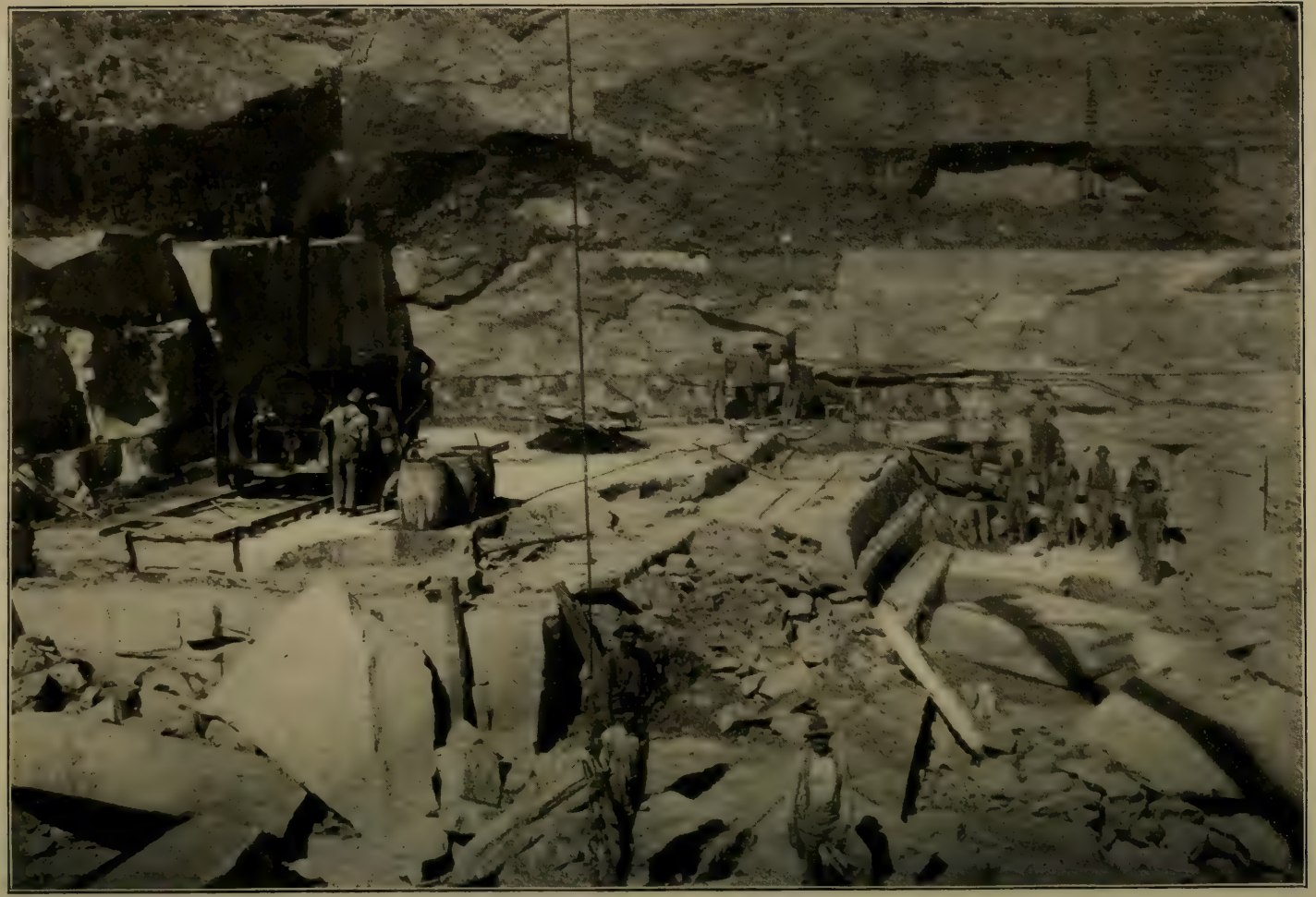
3 miles south of Penn Yan and ½ mile east of Keuka lake a quarry has been opened by S. Thayer. The quarry is very small, and the product is rough foundation stone, which is used locally. The stone is very coarse grained and shaly. The vertical joints are very irregular. 10 feet of rock cover the 4 feet of bed of stone.

F. E. Hoyt and Warren Sanford have opened quarries south of Penn Yan, but they have not been worked for several years.

James Woodruff's quarry is 3½ miles south of Penn Yan and 1½ miles east of Keuka lake. The bed of workable stone is 2 feet thick with 5 feet of shale and earth top. The stone is fine grained, dark blue, and compact. The bed is horizontal. The product is rough building stone, which is used in Penn Yan for foundations.

Himrod, Yates co.

Evan Potter's quarry is situated 1½ miles east of Himrod. The stone is fine grained and very dark blue. The bed is 2 feet



H. T. Dickinson, photo.

Bluestone quarry of Genesee Valley bluestone co., 3 miles south of Portageville N. Y. on

thick with 3 feet of shale and earth overburden. The product is all rough building stone, some of which is used for culverts on the roads. Louis Cheney has also worked a small quarry near Himrod, but not for some time.

Watkins, Schuyler co.

No quarries are worked continuously here, but there is an opening in the hill 1½ miles south of Watkins, made by the Elmira and Watkins electric road, that is worked intermittently. The face at the back is 50 feet high and 200 feet long. Stone and shale are interbedded, the thickness of the stone approximating 12 feet. The stone is fine grained, even bedded and very dark blue. It is not handsome, but durable. The stone has been used for culverts on the electric railroad between Watkins and Elmira.

Portage, Livingston co.

The quarry of the Genessee Valley bluestone co. is 3 miles south of Portageville, just west of the Western New York and Pennsylvania railroad in Wyoming county. It has been worked for many years, and a large amount of stone has been produced.

The excavation is rectangular in shape, 120 feet x 210 feet. The stripping is of clay 20 to 40 feet thick, and increases on the western side. A great deal of trouble is experienced with the top, as part of it is in the nature of quicksand, and slides occur during the wet season, filling the opening with earth, sand and rock. The bed has been worked to a depth of 42 feet, divided into lifts by mud seams 2 to 8 feet apart. The lifts run in the following thicknesses vertically: 8 feet, 2 feet, 1½ feet, 3 feet, 2½ feet, 1⅔ feet, 1⅔ feet, 8 feet and 14 feet. The second lift from the bottom, 8 feet thick, contains a streak of stone containing a large amount of iron and is known as "black rock." This is of poor color and is sawed into flag. Just above the black rock the best stone is produced. The stone is fine grained and soft. The best is greenish blue. It is homogeneous in texture, easily worked and presents a very fine finish.

A representative specimen of this stone gave the following tests: Specific gravity 2.695, weight per cubic foot 168 lb, water absorbed 2.97%.

The loss by treatment with dilute $H_2 SO_4$ was .42%. Freezing and thawing tests produced but slight scaling. At a temperature of 1200° to 1400° F the color changed to a dull red. There were no checks, and the strength of the specimen was but little impaired. It is said to harden on exposure, and if quarried during cold weather will check badly from frost. Owing to the depth of the pit below the surrounding country, water is troublesome. It is removed by means of a steam pump. The quarry is also equipped with Wardwell channeling machine, Rand drill and steam derrick. The blocks are cut out by the channeling machine, which cuts to 5 feet 9 inches. The blocks are wedged out and lifted by the steam derrick. Drilling is done when necessary. A mill is run in connection with the quarry, where the stone is sawed, planed and rubbed for market. 37 men are employed during the quarrying season, which lasts from Mar. 15 to Nov. 30.

The stone is marketed chiefly in New York city. A side track runs into the quarry from the railroad. The price for block stone averages 60c a cubic foot. 42 to 43 carloads are shipped each month during the season.

Warsaw, Wyoming co.

Stone known in the trade as Warsaw bluestone is quarried by two firms 3½ miles south of Warsaw and 2 miles west of Rock Glen on the Erie railroad. Both quarries are on the same ledge of stone, within 25 yards of each other. The names of the firms are Warsaw bluestone co. and Otis & Gage. The latter firm has just begun operations this year.

The quarry formerly worked by the Warsaw bluestone co. at Rock Glen has been abandoned for some years, though the mill still stands and is connected with the present quarry by a railroad track. The bed of stone now worked is 35 feet thick. The top 5 feet are black rock and practically waste. The overburden consists of hardpan holding broken rock and is 15 feet thick. The bed is horizontal so far as can be seen. The lifts vary from 6 inches to 8 feet in thickness. In quality, color

H. T. Dickinson, photo.

Bluestone quarry of Warsaw bluestone co. at Rock Rift near Warsaw

H. T. Dickinson, photo.

and grain the stone is very similar to the Portage bluestone. It holds the color well on exposure and is easily worked.

The quarries are in the shape of irregular pits, the vertical joints forming the sides and ends. The blocks are cut, however, by channeling machines. The channel makes a cut 5 feet 9 inches in depth, $2\frac{1}{2}''$ wide at top and $1\frac{1}{4}''$ wide at the bottom; 18 to 20 linear feet can be cut every 10 hours. The level of the beds is below that of the surrounding country and water is very troublesome. It is handled by steam pumps.

The equipment of the Warsaw bluestone co. consists of a Wardwell channeling machine, three drills, a steam pump, two steam hoisting derricks; and a mill at Rock Glen with 12 gang saws, two planers, one borer, one circular saw, one lathe and four steam hoisting derricks. 45 men are employed in the quarry, and 20 men in the mill during the season.

Otis & Gage have a mill in course of erection within 100 yards of their quarry. A gravity railway connects the two. The mill is to be fully equipped with saws, planers, lathes etc. At the quarry there is in operation one Sullivan channeling machine, one steam drill, a steam hoisting derrick and a steam pump. 50 men are employed in quarry and mill.

Both mills are connected with the Erie railroad by side tracks. The market for this stone is in New York, Elmira, Corning, Binghamton, Philadelphia and Washington.

The following are examples of its use in construction: St Joseph's school at Buffalo; catholic school at Middletown; catholic church at Binghamton; armories at Brooklyn, Hudson, Hornellsville and Tonawanda; Vassar college at Poughkeepsie; residences at Corning, and the residence of N. S. Beardsley at Warsaw.

Waverly, Tioga co.

Gilbert Edgecomb's quarry is 2 miles north of Waverly, west of the Lehigh Valley railroad on a hillside. The quarry is 100 feet above the level of the valley. The hight of the face at the back is 75 feet, and the length 125 feet in a north and south direction. The bed is covered with 4 feet of earth. The stone

is coarse grained, thin bedded and blue to gray in color. The product is rough building stone. It is used locally for foundations and in bridge building on the Delaware, Lackawanna and Western railroad. The quarry was opened in 1870.

Elmira, Chemung co.

The quarries are on the western face of the hill forming the eastern boundary of the valley between Horseheads and Elmira. Two quarries only are in active operation, but a number of openings have been made.

W. B. Pratt's quarry has been opened 50 years. The hight at back is 40 to 60 feet. The bed of stone is not more than 25 feet thick and is thin bedded. It is covered with 25 feet of clay and shale top. The shale is made use of in the manufacture of paving brick. The stone is gray to very dark blue and fine grained. It is quarried by drilling deep holes and blasting. No dressing is done. The product is used for foundation work and cellar walls in Elmira. Six to seven men are employed during the season, which lasts seven or eight months in the year. A steam drill and hand derrick are part of the equipment.

A. Voight's quarry is 3½ miles north of Elmira on the same range as Pratt's. The bed of stone is 20 to 25 feet thick, with shaly streaks running through it. The stripping is 14 to 16 feet thick, 10 feet of which are shale, the balance being drift earth.

The stone varies in color from red to blue. It is fine grained and very dense. The vertical jointing, as at Pratt's quarry, is north and south and east and west. The product is rough building stone which is used locally. A hand derrick is in use. Two to four men are employed. The price of stone in Elmira averages $1 per perch.

On the hills bounding the valley of the Chemung river between Elmira and Big Flats, quarries have been opened on the lands of H. T. Clark and Sarah A. Conklin, but, owing to the long haul to market, are little worked.

QUARRIES IN THE SOUTHWESTERN COUNTIES

Corning, Steuben co.

But two quarries are being worked this season at Corning, though a number have been opened there in years past. Edward Kelly's quarry is situated 1½ miles southwest of Corning on a hillside. The stone is fine grained and gray, specially in the upper part of the bed. In the lower part of the bed the stone has a pinkish blue appearance.

At the top are 30 feet of shale and dirt, in which there are a few courses of good stone. Below this are 8 feet of stone, which is blasted out and broken up for rough foundation work. This quarry has produced a better quality of stone, which was dressed and used in the reformatory buildings at Elmira and in the catholic church at Corning. The equipment consists of a hand derrick. Two to three men are employed according to demand.

George Barnard's quarry is ¾ of a mile southeast of Corning. The ledge has been opened up 250 feet in an east and west direction. The hight of the face is 50 feet, of which 30 feet are shale and consequently worthless.

The lifts vary from 3 inches to 2 feet and are fairly regular. The stone is gray with a pink tinge, fine grained and somewhat reedy. The vertical joints are quite smooth and have an east and west direction. The product is all foundation stone and its market is local. The quarry is equipped with hand derrick.

A. I. Martin owns a quarry ½ mile west of Mossy Glen, but it has not been worked for the last two seasons. The bed is 6 feet thick, with 6 feet of clay top. The stone is fine grained, bluish gray and reedy. It is used for foundation work.

Bath, Steuben co.

The quarry of W. and George Jinks is 2 miles northeast of Bath and 250 feet above the valley, on hillside. The hight of the face at the back is 50 feet, of which 20 to 25 feet produce marketable stone, the upper 30 feet being shale and clay. The courses of stone vary in thickness from 3″ to 18″ and are inter-

stratified with shale. The strata are horizontal. The stone is fine grained and of a light gray color. It has been used for cut stone in the protestant episcopal church and county buildings at Bath, but is now quarried only for foundation work.

Just below this quarry another opening has been made in the hill. 15 feet of face are exposed, 8 feet of which are salable stone. The stone is gray, but has a whitish tinge. The lifts are somewhat heavier than in the quarry above.

The quarry of V. Holmes is situated $1\frac{1}{4}$ miles southwest of Bath. The ledge exposed is 45 feet thick. On top are 12 feet of clay and shale. Below this the courses of stone are interstratified with the shale. There are probably 8 feet of stone in the bed. The stone is fine grained and dark gray. It is quarried for cellar and rough work. It has not been worked the past season.

Near the Soldiers home at Bath stone has been quarried for the foundations of buildings and for road metal. The face is 125 feet high and 300 feet long. The sandstone is even bedded, of a gray color, and interstratified with shale. The vertical jointing is rough and irregular, but has a north and south and east and west direction. The dip is to the south and west and the lower strata are so covered with rubbish that it is impossible to determine the difference in quality of the stone in the beds.

Cohocton, Steuben co.

No quarries have been worked the past season at Cohocton on account of lack of demand for the stone.

Fred Zimmers's quarry lies $2\frac{1}{2}$ miles due west of Cohocton. The bed of stone, 4 feet thick, is covered with 15 feet of shale, in which some stone is interbedded. The product has been used for foundation work. The stone is fine grained and light gray. The quarry has not been worked for three years.

F. F. Woodworth's quarry is 3 miles northeast of Cohocton and two miles southeast of Atlanta, on a hillside 250 feet above the valley. 8 feet of shale and soil cover the 30 feet of stone courses, which vary in thickness from 3 inches to 2 feet. The

H. T. Dickinson, photo.

Sandstone quarry of F. F. Woodworth at Cohocton N. Y., not worked for some years

beds are nearly horizontal and divided by vertical joints, which run north and south and east and west, but are rough and irregular. The product is flag, which is sold locally and also shipped abroad by way of the Erie and Delaware, Lackawanna and Western railroads.

Dansville, Livingston co.

Only one quarry is worked at Dansville, that of Jacob Schubmehl, which is on the south end of hill which forms the eastern boundary of the valley in which Dansville lies. It is 2½ miles southwest of the town above the Delaware, Lackawanna and Western railroad. The quarry face is 600 feet long, in an east and west direction, and 50 feet high. The top is of shale 15 feet thick, and beneath it shale and stone are interstratified. The stone is light gray and fine grained. In the lower courses the stone has a greenish tinge. The beds average 2½ feet in thickness. There is an abundance of reeds or splitting planes in the stone. The product is chiefly rough foundation work, and the market a local one.

Hornellsville, Steuben co.

Two quarries are being worked at Hornellsville. James May's quarry is 1¾ miles south of the town on a hillside, 100 feet above the valley. Two openings, 7 rods apart, on the same ledge, are being worked. A vertical section shows 10 feet of clay and broken rock, and 20 feet of stone. The stone is fine grained and bluish gray in color. The bed dips to the southwest gently. The stone is divided by vertical joints running n. 50 e. and s. 40 w. The stone is susceptible to disintegration if quarried during cold weather. The product is chiefly common building stone for local consumption. Two to three men are employed during the year.

Joseph S. Cobb's quarry is in the same range as May's, and the stone is very similar. The face of the quarry is 900 feet long and 50 feet high at the back. There are 8 feet of stripping of clay, 25 feet of light blue sandstone (which is used for rough work) and 12 feet of blue gray stone. The lower bed is used for cut stone, and the trimmings in the Bryant & Park schoolhouse at Hornellsville are from this quarry. As the ledge is worked into the

hill, the lifts become very heavy and hard to handle. This is caused by the ledge being opened up such a long distance. Three men are employed during the year.

Belmont, Allegany co.

Leander Gordon and Eugene Pease own quarries near here. Gordon's quarries are ½ mile northwest of the village. There are two openings: one near the road, producing flag, and one farther back for building stone. The flag quarry is very small. The stone is fine grained and gray. The bed is 4½ feet thick, with 5 to 6 feet of dirt on top, and dips to the northwest. The lifts vary from 2″ to 8″. The flag is for local consumption. The quarry for building stone has a depth of bed of 18 to 20 feet, with 6 to 7 feet of shale overburden, in which some stone is interbedded. The stone is of the same quality as the flag quarry, but runs in heavier lifts, 12″ to 24″. The stone when cut has a pleasing appearance, but stains on exposure. The quarry has not been worked in some time.

The quarry of Eugene Pease is 2½ miles southwest of Belmont. The bed is 12 feet thick, but the upper 10 feet are badly broken and are used only for common building stone. The lower 2 feet produce some cut stone. The stone is of medium grain and greenish gray. The top is 4 feet thick and of soil. The product is all sold locally.

Angelica, Allegany co.

William Tracy has opened a flag quarry 1½ miles south of the village. It has been opened one year. The bed of stone is 4 feet thick, interbedded with shale. The lifts vary from 8″ to 2 feet, and can be split. The stone is light gray and fine grained. The bed is nearly horizontal and is divided by a series of irregular vertical joints. The product is sold in Angelica, Belmont, and other neighboring villages.

Belvidere, Allegany co.

H. Whitcomb's quarry has not been worked in 10 years.

Cuba, Allegany co.

Jesse Adams works a quarry just south of the Erie railroad station. The length of face in an east and west direction is

500 feet, and the maximum hight 30 feet. The bed is 8 feet thick, and dips to the south 1 in 7. The top of 10 to 22 feet is of shale, broken rock and dirt. In this there is some stone good enough for rough work. The stone is light gray and fine grained. The lifts vary from 2″ to 12″ in thickness. The product is used locally for common work.

Rockville, Allegany co.

Quarry of A. Searles 1 mile south of Rockville station. The bed of stone is 5 to 6 feet thick and is rough. 8 feet of soil and broken rock cover the bed. The stone is light gray and fine grained. The lifts vary from 6″ to 12″. The vertical jointing is northeast and southwest and northwest and southeast. Cross bedding appears in the bed. A line fence divided this quarry from Earl Herkimer's quarry, which is on the same ledge. The product is used locally in the surrounding towns for flagging and foundation work.

Belfast, Allegany co.

No quarry has been worked near Belfast in seven years.

Olean, Cattaraugus co.

The quarry of the Olean bluestone co. has been abandoned for five years, and the mill has been torn down.

John McCann is working a quarry 2½ miles south of Olean in Wild Cat hollow. The bed of stone is 12 feet thick and is covered with a top of 8 feet of broken rock and soil. The stone is fine grained and has an oily appearance when first quarried, but turns light gray on exposure. The quarry face is 700 feet long and extends around the hill. The ledge has been worked this way to avoid the heavy top, in working into the hill. The lifts vary from 8″ to 2 feet. The stone is used for common stone and curbing in Olean. The common stone sells for $1.25 a perch and the curb for 18c a linear foot. Two to three men are employed.

Joseph Rounds quarries stone on the same ledge south of McCann.

Jamestown, Chautauqua co.

Six openings have been made in the eastern part of the town, in the hill on the right bank of the Chautauqua lake outlet,

and one on the left bank of the outlet. The latter quarry is that of the Jamestown shale paving brick co. This quarry was originally opened for building stone, but the amount of shale became so great that the brick works were built to dispose of it. Now the quarrying of the stone for building is a minor affair. The ledge opened is 62 feet thick. The upper 25 feet are of shale and thin layers of stone, all of which is used for making brick. Below occurs the stone for building purposes. The stone is bluish, fine grained, and hard. The vertical joints are at irregular distances apart.

The systems run n. 30 w. and s. 55 w., the first being vertical, the second pitching steeply to the northwest. The lifts vary from 6″ to 14″. The product includes common building stone and cut work. It is sold in Jamestown for $6 to $7 a cord.

The quarries on the right bank of the outlet are at irregular intervals, the distance from the first to the last being about ¾ of a mile. They have been worked extensively at one time, but are small producers now. The maximum hight of face exposed is 65 feet. Below the top 5 feet of earth, stone and shale are interbedded. The upper courses produce only common building stone, while the lower beds are thicker, of better color and grain, and are cut for house trimmings for local market. No machinery of any kind is in use, but three of the openings are provided with hand derricks.

Watts Flats, Chautauqua co.

No quarries are in operation here.

North Clymer, Chautauqua co.

Two quarries on the same ledge have been worked ½ mile east of the railroad station. The bed of stone is 20 feet thick, but the top 4 feet are too rough for good stone. Above the bed are 3 feet of earth. The lifts vary from 1 foot to 3½ feet. The bed dips gently to the northeast. The stone is light gray and fine grained, and liable to weather badly. The quarries are owned by P. J. Reed and B. P. Smith, but have not been worked for three seasons.

This stone has been used for bridge abutments in Buffalo and on the Buffalo, Rochester and Pittsburg railroad.

Westfield, Chautauqua co.

Albert Elliott's quarry. A small quarry situated 2 miles northeast of Westfield and ¼ of a mile south of Lake Erie. The top of earth 4 to 5 feet thick covers a bed of stone 3 feet thick, with seams 2″ to 3″ apart. The stone is fine grained and blue gray. Some shale is interbedded with the stone, which latter has been used in arches for bridges and foundations. The quarry is very small and is worked only intermittently.

Laona, Chautauqua co.

Several quarries have been opened here on a line running northwest and southeast, which passes just north of Laona. Five or six quarries are on this line, but the only quarry that has been worked for some time is that of George R. Moore. This quarry is 1½ miles northwest of Laona. The opening is in an open field. The bed of stone is 5 feet thick, with top of 6 to 8 feet, 2 feet of which are shale, and the balance earth. The stone is fine grained and grayish blue. The lifts vary from 3″ to 6″ and are rather rough. The product is used for foundations in Dunkirk and Fredonia. 500 cords of stone worth $6 a cord at the quarry have been taken out of the quarry the past season.

John Wagner's quarry is the most southern on the belt and is just north of Laona. It has not been worked for a few years. It was opened 40 years ago. Some cut stone for trimmings has been produced from this quarry.

Franklinville, Cattaraugus co.

There is a sandstone quarry here which was not visited. No details are known.

Reorganization in the Hudson river valley

The bluestone interests in the vicinity of Rondout are now controlled by the following firms: Hudson river bluestone company, Malden, Saugerties, Glasco, Rondout, Brodheads Bridge and Wilbur; John Maxwell, yards at Saugerties, Glasco and Catskill; J. J. Sweeney & Son, Saugerties; and E. Riseley, West Hurley.

The Hudson river bluestone company has absorbed the business of Hewitt Boice, Rondout; Julius Osterhoudt, Wilbur; J. J. Sweeney, Wilbur; Rogers and Tappan, Wilbur and T. J. Dunn & Co., Malden. This company is working its own quarries at Cold Brook, Mt Pleasant, Arkville and Kingston. These quarries are all fitted with steam derricks and drills, employ about 300 men and operate 15 barges. Yearly value of business, $500,000.

INDEX

Adams, Jesse, quarry, 100–1.
Adams, Jones &, quarry, 78–79.
Allegany county, quarries, 100.
Angelica, quarry, 100.
Arbecker Bros., quarry, 50.
Ashbury, quarries, 19.
Ashton, quarries, 61, 62.
Atwood, quarries, 37, 42-43.

Bach & Burton, quarry, 54.
Bahan, Crozier &, quarry, 81.
Barclay, Chase &, quarry, 62.
Barger, J. G., quarry, 90.
Barley, Osterhoudt &, quarry, 44.
Barnard, George, quarry, 97.
Barton, A., quarry, 64.
Barton, Howard, quarry, 63.
Barton & Lyons, quarry, 63.
Bates, Wilbur J., quarry, 91–92.
Bath, quarries, 97–98.
Beagle, Arthur, quarry, 79.
Beagle, Elmer, quarry, 80.
Beagle & Mayo, quarry, 79.
Bean & Lewis, quarries, 17.
Bearsville, quarries, 59; quarries near, 57, 58.
Beatty, J. H., quarry, 43.
Beatty, Jason, quarry, 43–44.
Beatty & Vandermark, quarry, 44.
Becker Bros., quarry, 51, 53.
Bedding, 7–9.
Beesmer, Christiana &, quarry, 64.
Beesmer, Eckert &, quarry, 63.
Beesmer & Hover, quarry, 62.
Belmont, quarries, 100.
Biggs, F. C., quarry, 91.
Bishop, Aaron, quarry, 63.
Black jack, 68.
Black reed, 7.
Blasting, Knox system of, 11.
Blocks, 46.
Bloom, Herbert, quarry, 17.
Bloom, Jacob, James Lane &, quarry, 17.
Bluestone, area covered by, 5; dressing, 12–13; joints and bedding, 7–9; marketing, 16; microscopic structure and quality, 6; mill treatment, 5; quarrying, 10–12; rent and ownership of quarries, 13–14; stripping, 9–10; term, 5; thickness of beds, 9; three classes, 6; transportation, 14–15.
Boice, Hewitt, 35, 37, 39, 40, 41, 42, 58, 62, 63, 64, 65.
Bond, Frank, quarry, 69.
Bonsteil Bros., quarry, 58.
Bottomed, term, 8.
Bovee, Rightmeyer, Craft &, quarry, 21.
Brennan Bros. & Ledwith, quarry, 24–25.
Brink & Jones, quarry, 23.
Brodhead, William R., quarry, 41.
Brodhead's Bridge, quarries, 63; mills at, 65.
Broome county, quarries in, 67–86.
Brower, Flowers &, quarry, 58.
Brower, Ostrander &, quarry, 61.
Brower, Philip, quarry, 60.
Brower & De Graff, quarry, 58.
Bunt, Dale &, quarry, 53.
Burke, Daniel J., quarry, 25.
Burkins & Flowers, quarry, 61.
Burns, Hart &, quarry, 33.
Burns Bros., quarry, 36.
Burt, Teetzel &, quarry, 53.
Burt, Wase &, quarry, 51.
Burton, Bach &, quarry, 54.
Burton Bros., quarry, 55.
Bush, Cornish &, quarry, 63–64.
Bush & De Boice, quarry, 43.
Byer, Plass &, quarry, 54.

Cahill, Hanrahan &, quarry, 83.
Cairns, Ralph, quarry, 70.
Cairns, William, quarry, 70.
Callahan, B. C., quarry, 36.

Callahan, Patrick, quarry, 52–53.
Canine & Longendyke, quarry, 56.
Carle, Henry, quarry, 59.
Carle, Levi, quarry, 28–29.
Carle & York, quarries, 29–30.
Carle Bros., quarry, 31.
Carnright, Alfonso, quarry, 20–21.
Carson & Merrihew, quarry, 64.
Carty & Rourke, quarry, 22–23.
Catskill, quarries near, 17.
Catskill group, 5.
Cattaraugus county, quarries, 101, 103.
Cayuga county, quarries, 90.
Chambers, George, quarry, 65.
Charleton Co., McConnell &, quarry, 38.
Charlton, William, quarry, 37.
Chase & Barclay, quarry, 62.
Chautauqua county, quarries, 101-3.
Chemung county, quarries, 96.
Chemung group, 5.
Chenango county, quarries, 87–89.
Cheney, Louis, quarry, 93.
Christian, O. E., quarry, 44.
Christiana & Beesmer, quarry, 64.
Clark, H. T., quarry, 96.
Clarke, F. G. bluestone co., 87–88, 89.
Clearwater, Conner & Hotaling, quarry, 40–41.
Clearwater, John, quarry, 41.
Clove, Doyle &, quarry, 54–55.
Cobb, Joseph S., quarry, 99–100.
Cockburn, quarries, 28–29, 31, 34.
Cockburn hill, quarries, 25; quarries near, 27.
Cohocton, quarries, 98–99.
Cole, Abraham & Son, quarry, 55.
Cole, Charles, quarry, 53.
Comfort & Wood, quarry, 84–85.
Conklin, Sarah A., quarry, 96.
Conlon Bros., quarry, 29.
Conner, Clearwater, Hotaling &, quarry, 40–41.
Connor, Hector, quarry, 44.
Connor, Jake, quarry, 29.
Connors, Flanagan &, quarry, 23–24.
Conrow & Hauyck, quarry, 77.
Conroy, T. J., quarry, 38.
Cook, C. E., quarry, 21.
Cook & Ransome, quarry, 50.
Cook & Schoonmaker, quarry, 21.
Corning, quarries, 97.
Cornish & Bush, quarry, 63–64.
Cotter, E. J., quarry, 72.
Craft, Rightmeyer, Bovee &, quarry, 21.
Cronin, Eygo Bros. &, quarry, 24.
Crozier & Bahan, quarry, 81.
Cuba, quarries, 100–1.
Cuddike, John, quarry, 85.
Cunningham & Schoonmaker, quarry, 22.
Curtis & Smith, quarry, 75.
Cusick, John, quarry, 24.
Cusick & Murray, quarry, 90–91.

Daisy, quarries, 55; quarries near, 55.
Dale & Bunt, quarry, 53.
Dansville, quarry, 99.
Darrigan, Daniel, quarry, 26.
Darrigan, James, quarries, 26.
Darrigan, Mrs John, quarry, 26.
Davis, George, quarry, 69.
Davis, Green L., quarry, 42.
Davis, Stratton &, quarry, 58.
Davis Bros., quarry, 44.
De Boice, Bush &, quarry, 43.
Dederick & Frieze, quarry, 19.
Dederick Bros., quarry, 18.
De Graff, A., quarry, 40.
De Graff, Brower &, quarry, 58.
De Graff, Stoutenburgh &, quarry, 58.
De Graffe, Greene &, quarry, 62.
Delaware county, quarries in, 67–86.
Delemater & Hommell, quarry, 51.
Deposit, quarries, 74–75, 76–78; quarries near, 77; stone buyers, 86.
Deposit stone co., 76, 86.
Depuy, James, quarry, 31.
Deverey, Owen, quarry, 19.
Devine, James, quarry, 38.
De Witt, G., quarry, 64.
Deyo & Son, quarry, 68–69.
Diamond saw, 13.
Dirig, Johnson &, quarry, 83.

Dolan, Stewart &, quarry, 48.
Doyle, Albert, quarry, 55.
Doyle, Myers &, quarry, 53.
Doyle, William, quarry, 31.
Doyle & Clove, quarry, 54–55.
Doyle & Co., quarry, 38.
Dressing bluestone, 12–13.
Driscoll Bros., quarry, 92.
Dudley & North, quarry, 63.
Dudrey, Van Kleek &, quarry, 63.
Dunn, Martin, quarry, 23.
Dunn, T. J., & Co., 22, 28, 66.
Dunn Bros., quarry, 39–40.
Dutch Settlement, quarries, 17; quarries near, 32, 34.

East Branch, quarries, 74.
Eckert & Beesmer, quarry, 63.
Edge stone, 6.
Edgecomb, Gilbert, quarry, 95.
Egner, Erby &, quarry, 52.
Elliott, Albert, quarry, 103.
Elliott, E., quarry, 57.
Elliott, Robert, quarry, 42.
Elmira, quarries, 96.
Ennis, Charles, quarry, 43.
Ennis & Jones, quarry, 41.
Erby & Egner, quarry, 52.
Eygo Bros. & Cronin, quarry, 24.

Fawns, quarries, 47; quarries near, 45.
Felton, Nelson, quarry, 30.
Ferguson, John, quarry, 24.
Firman, David, quarry, 61.
Fish Creek, quarries, 17, 44; quarries near, 23, 24, 25, 31.
Fish Eddy, quarries, 73.
Fitch & Randall, quarry, 81–82.
Flagstone, 6.
Flanagan & Connors, quarry, 23–24.
Flowers, Burkins &, quarry, 61.
Flowers & Brower, quarry, 58.
Flynn, Wyman Spring &, quarry, 23.
Foley, K., quarry, 21.
Ford, M. J., quarry, 82.
France, Rightmeyer &, quarry, 52.
Franklin Depot, quarries, 68–69.
Franklinville, quarry, 103.
Freeman, Ostram &, quarry, 78.
Frieze, Dederick &, quarry, 19.
Fritz, Peter, quarry, 72.
Fuller, W., quarry, 49.

Gad, Tom, quarry, 37.
Gaddis, J. & Son, quarry, 33.
Gage, Otis &, quarry, 94.
Gang saw, 13.
Genesee Valley bluestone co., 93.
Glasco, derrick at, 66; docks at, 66.
Glenford, quarries, 58, 60–61.
Goebel, Cornelius, quarry, 42.
Gooches, William, quarry, 41.
Goodyears, quarry, 90.
Gordon, Leander, quarry, 100.
Grant, Owen, quarry, 37–38.
Green, Charles, quarry, 32.
Greenë, Wesley, quarries, 31.
Greene & De Graffe, quarry, 62.
Greene Bros., quarry, 44.
Greene county, bluestone quarries in, 17–67.
Grey, Wallace, quarry, 61.
Griffen, Patrick, quarry, 79.
Grimsbeck, Arnold, quarry, 83.
Gross, John, quarry, 60.

Hackett, Kelly &, quarry, 28.
Hackett, Vedder &, quarry, 27.
Hackett & McCormick, quarry, 29.
Hackett Bros., quarry, 29.
Haines, Lamouree &, quarry, 49.
Haines, quarry near, 49.
Hälbleib, Constance, quarry, 34.
Hale Eddy, quarries, 75, 78–79.
Hallihan hill, quarries, 34.
Hamden, quarries, 70–71.
Hamilton group, 5.
Hancock, quarries, 71–73, 79–84; quarry near, 84; stone buyers at, 85–86.
Hanrahan, P., quarry, 84.
Hanrahan & Cahill, quarry, 83.
Hart, Henry, quarry, 32.
Hart & Burns, quarry, 33.
Harvey, Con, quarry, 20.
Hasenpflug, John, quarry, 58.
Hauyck, Conrow &, quarry, 77.

Hawley, Christopher & Sylvester Stone, quarry, 47.
Hayen, William, quarry, 24.
Hayes, Thomas, quarry, 36.
Head-offs, 7.
Headers, 7.
Heads, 7.
Herkimer, Earl, quarry, 101.
Herrick, McGhee &, quarry, 57.
High bank, quarries near, 29.
High Falls, quarries near, 17, 19; mills at, 66.
Highwoods, quarries, 17, 26, 27–28, 29–32, 44, 47; quarries near, 23, 24.
Himrod, quarries, 92–93.
Hobbs & Tupper, quarry, 75.
Holden, Oliver, quarry, 55.
Hollenbeck & Miller, quarry, 21.
Holmes, V., quarry, 98.
Hommell, Abraham, quarry, 51.
Hommell, Delemater &, quarry, 51.
Hommell, Snyder &, quarry, 51–52.
Hommell, Valk &, quarry, 49.
Hommell & Ransome, quarries, 47.
Hommell & Rightmeyer, quarry, 49.
Hommell & Snyder, quarry, 50.
Hommell Bros., quarries, 47, 50.
Hood, L., William Lane &, quarry, 17.
Hornellsville, quarries, 99–100.
Hotaling, Clearwater, Conner &, quarry, 40–41.
Hover, Beesmer &, quarry, 62.
Howard, James, quarry, 36.
Hoyt, F. E., quarry, 92.
Hudson river, list of buyers on, 65–66.
Hudson river bluestone co., 23, 25, 30, 38, 40, 41, 51, 54, 55, 57, 58, 59, 60, 63, 66.
Hudson River Valley, reorganization in, 103.
Huff & Young, quarry, 52.
Hughes, Oliver, quarry, 62.
Hummel, Lawrence, quarry, 22.
Hunt, J. T., quarry, 91.
Huntington, Ellsworth, quarry, 71.
Hurley, quarries, 39–40, 41–42.
Hyatt, D. E., quarry, 61.

Ithaca, quarries, 91–92.

Jamestown, quarries, 101–2.
Jersey City, stone buyers, 86.
Jinks, W. & George, quarry, 97–98.
Jockey hill, quarries, 17, 35, 37.
Johnson & Dirig, quarry, 83.
Johnson & Piert, quarry, 61.
Joints, 7–9.
Jones, Brink &, quarry, 23.
Jones, Ennis &, quarry, 41.
Jones, John, quarry, 60.
Jones & Adams, quarry, 78–79.
Jones & Co., quarry, 62.

Kaaterskill, quarries, 45; quarries near, 48.
Katrine, quarries, 34.
Kazenstein, G. W., 82, 86.
Kearney, Edward, quarry, 82–83.
Keator, Resne &, quarry, 64.
Keegan, Peter, quarry, 57.
Kelley, Edward, quarry, 97.
Kelly & Hackett, quarry, 28.
Kennedy, Richard, quarry, 79–80.
Kenney, Lawrence, quarry, 28.
Kilgore's switch, quarries near, 85.
King's Ferry, quarries, 90.
Kingsbury, Travis &, 75, 78, 79, 80, 86; quarry, 81.
Kingston, quarries, 28; mills at, 65.
Kinney & Lee, quarry, 75.
Kirkpatrick Bros., 72, 77, 78, 79, 81, 82, 83, 84, 85.
Kiskatom, quarries, 18–19; quarries near, 17.
Kittle & Co., quarry, 60.
Knox system of blasting, 11.
Kraft, Mack &, quarry, 21.
Krantz, Fred, quarry, 40.
Krell, Scheffel &, quarry, 34.
Kripple Bush, quarries, 42, 43.
Krom, Lockwood &, quarry, 42–43.
Krum, Wagner &, quarry, 43.

Lahert Bros., quarry, 26.
Lahey, McDonald &, quarry, 33.
Lake Hill, quarries near, 59.
Lamb Bros., quarry, 39.

Lamouree, Lyman, quarry, 48.
Lamouree & Haines, quarry, 49.
Lane, James, & Jacob Bloom, quarry, 17.
Lane, Martin, quarry, 39.
Lane, William & L. Hood, quarry, 17.
Lane Bros., quarry, 17.
Lannigan, Richard, quarry, 26.
Lannigan, William, quarry, 28.
Lannigan Bros., quarry, 34.
Laona, quarry, 103.
Lapala, quarries, 17, 37, 40; quarries near, 42.
Lasher, Oscar, quarry, 58.
Lasher Bros., quarry, 27.
Leahey Bros., quarry, 72–73.
Ledwith, Brennan Bros. &, quarry, 24–25.
Lee, Burt, quarry, 80–81.
Lee, Kinney &, quarry, 75.
Leppo, George, jr, quarry, 59.
Lewis, Bean &, quarry, 17–18.
Lifts, 7.
Lindsay, Snyder &, quarry, 53.
Linkroum, Charles, quarry, 74–75.
Livingston county, quarries, 93–94, 99.
Lockwood, T. H., quarry, 25–26.
Lockwood & Krom, quarry, 42–43.
Lomontville, quarries, 40, 41, 42.
Longendyke, Canine &, quarry, 56.
Longendyke, J. A., quarry, 32.
Lord, G. N., quarry, 78.
Lordville, quarries, 85; stone buyers, 86.
Lyons, Barton &, quarry, 63.

McAuliffe & Terwilliger, quarry, 61.
McAvoy, Patrick, quarry, 77.
McCaffery, John & Co., quarry, 35.
McCaffery, W., quarry, 35.
McCann, John, quarry, 101.
McConnell & Charleton Co., quarry, 38.
McCormick, Hackett &, quarry, 29.
McDonald, T., quarries, 35, 36.
McDonald & Lahey, quarry, 33.
McGhee, Edward, quarry, 57.
McGhee & Herrick, quarry, 57.
McGhee & Waste, quarry, 57.
McGuire, Chris., quarries, 34.
Mack & Kraft, quarry, 21.
Mackey hill, quarries, 17, 37, 42.
McMullen, Frank, quarry, 40.
McMullin, Jacob, quarry, 44.
McRieff, Mrs J., quarry, 37.
Madden, P. J., 86; quarry, 76–77.
Malden, mills at, 66.
Mann, Levi, quarry, 56–57.
Manterstuck, Whittaker &, quarries, 27.
Marketing bluestone, 16.
Martin, A. I., quarry, 97.
Maxwell, James, 23, 24, 25, 26, 28, 29, 30, 31, 32, 33, 34, 47, 51, 52, 53, 54, 55, 56, 57, 59, 66.
Maxwell, Joseph, 22.
May, James, quarry, 99.
Mayo, Beagle &, quarry, 79.
Merrihew, Carson &, quarry, 64.
Merrihew ledge, quarries, 64–65.
Merritt, J., quarry, 70–71.
Meyers, Benjamin, quarry, 31.
Miller, Abraham, & Co., quarry, 19–20.
Miller, E., quarry, 60.
Miller, Hollenbeck &, quarry, 21.
Miller, W. H., quarry, 41.
Mink hollow, quarry, 59.
Minko, Van Aken &, quarry, 79.
Moon, P. A., quarry, 48.
Moore, I. J., quarry, 71.
Moore, Robert, quarry, 81.
Morey hill, quarries, 37.
Morgan hill, quarries, 37, 39.
Mt Airy, quarry near, 22.
Mountain stone, 45.
Mower, N., quarry, 56.
Mower, Peter, quarry, 55.
Murphy, John, quarry, 36.
Murray, Cusick &, quarry, 90–91.
Murray, Jack, quarry, 57.
Myers, Harvey, quarry, 19.
Myers & Doyle, quarry, 53–54.

Nason, F. L., quoted, 6.
Nevin, James & Sons, quarry, 73.
North, Dudley &, quarry, 63.

North Clymer, quarries, 102–3.
Nuger, Van Hoevenburg &, quarry, 33.

O'Connor, Van Steenburg &, quarry, 22.
O'Hara, Peter, quarry, 91.
Olds & Miller, quarry, 86–87.
Olean, quarries, 101.
Olive, quarries, 62.
Olivebridge, quarries, 62–65.
O'Neill, James, quarry, 39.
Oneonta, quarries, 86–87.
Oquaga Lake, quarries, 75–76.
O'Rourke, John, quarry, 21.
O'Rourke, Michael, quarry, 21–22.
O'Rourke & Stewart, quarry, 84.
Osterhoudt, Julius, 35, 41, 43, 60, 66.
Osterhoudt & Barley, quarry, 44.
Ostram & Freeman, quarry, 78.
Ostrander & Brower, quarry, 61.
Otis & Gage, quarry, 94.
Otsego co., quarries, 86–87.
Oxford, quarries, 87–89.

Palen, Ezra, quarry, 64.
Palenville, quarries, 17, 47–50.
Pease, Eugene, quarry, 100.
Pencil, 8.
Penn Yan, quarries, 92.
Piert, Johnson &, quarry, 61.
Pineville, quarries, 71.
Plaat Clove, quarries, 50–51, 53.
Plaaterskill, quarries, 45, 51.
Planer, 13.
Plass & Ryer, quarry, 54.
Portage, quarries, 93–94.
Portage group, 5.
Potter, Evan, quarry, 92–93.
Pratt, W. B., quarry, 96.
Prigge, Henry, 86; quarry, 85.
Proskine, Christopher, quarry, 73.
Purcell, John, quarry, 38.

Quarrying bluestone, 10–12.
Quarryville, quarries, 17, 19–21, 44.

Rafferty, Daniel, quarry, 28.
Rafferty, Thomas, quarry, 28.
Randall, Fitch &, quarry, 81–82.
Randall Bros., 72, 73, 81, 82, 83, 86.
Randolph Bros., quarry, 83.
Ransome, Cook &, quarry, 50.
Ransome, Hommell &, quarries, 47.
Read Creek, quarries, 74.
Reed, P. J., quarry, 102.
Reeds, 7.
Rent and ownership of bluestone quarries, 13–14.
Resne & Keator, quarry, 64.
Rhodes, 74.
Rice & Co., quarry, 82.
Rightmeyer, Bovee & Craft, quarry, 21.
Rightmeyer, Hommell &, quarry, 49.
Rightmeyer & France, quarry, 52.
Riley, James, quarry, 57.
Riley, Michael, quarry, 65.
Riley Bros., quarry, 28.
Rind, Richard, quarry, 28.
Roche, Thomas, quarry, 80.
Rock, 6, 9.
Rock Rift, quarries, 71.
Rockville, quarries, 101.
Rogers & Tappan, 60, 61, 62.
Rondout, mills, at, 65, 66.
Roosa, W. D., quarry, 44.
Rose Bros., quarry, 44.
Roseville, quarries, 40.
Rough streak, 8.
Rounds, Joseph, quarry, 101.
Rourke, Carty &, quarry, 22.
Rubbing, 13.
Ruby, quarries, 32–34.
Russell, John, quarry, 62.

Sampson, John J., quarry, 41.
Sampson, Thomas, quarry, 41.
Samsonville, quarry, 65.
Sandstones, area covered by, 4; color, 5; dip of beds, 4; elevation of beds, 4; quarries, 4; texture, 4–5.
Sanford, Warren, quarry, 92.
"Sap" rock, 68.
Saugerties, quarry, 25-26; docks at, 66.
Sawing, 12.

Sawkill, quarries, 35–37.
Sawkill creek, quarries, 34, 35.
Saxton, quarries, 19, 49.
Scarawan, quarries, 37, 42, 43.
Scheffel & Krell, quarry, 34.
Schoonmaker, Cook &, quarry, 21.
Schoonmaker, Cunningham &, quarry, 22.
Schoonmaker, Egbert, quarry, 56.
Schoonmaker & Young, quarries, 51.
Schubmehl, Jacob, quarry, 99.
Schuyler county, quarry, 93.
Scott, John W., quarry, 77.
Scott, William, quarry, 26.
Scriver, J., quarry, 41.
Scully, Thomas, quarry, 84.
Scully, Thomas F., quarry, 40.
Searles, A., quarry, 101.
Secor, Robert, quarry, 62.
Shady, quarries, 59.
Shaefer Bros., quarry, 80.
Shalk, John, quarry, 52.
Sheehan Bros., quarries, 34, 37.
Sheely, W., quarry, 36.
Shellman, George, quarry, 77–78.
Shellman, Riley, quarry, 76.
Shellman & Warner, quarry, 78.
Sherman Pa., quarry, 75.
Shokan, quarries, 61.
Shultis, A. E., quarry, 59.
Shultis, C., quarry, 59.
Shultis, Samuel, quarry, 59.
Side seams, 7.
Simmons, Frank & Lee Wolven, quarry, 47–48.
Skchill, John, quarry, 27.
Skinner, Sydney, quarry, 74.
Slossenburg, T., quarry, 71.
Smith, B. P., quarry, 102.
Smith, Curtis &, quarry, 75.
Smith, Snow &, quarry, 43.
Smith & Yeager, 17, 18, 22; quarry, 18–19.
Smock, J. C., tests made under direction of, 87–88.
Snake rock quarries, 58–64.
Snow & Smith, quarry, 43.
Snyder, Fred, quarry, 54.
Snyder, Hommell &, quarry, 50.
Snyder & Hommell, quarry, 51–52.
Snyder & Lindsay, quarry, 53.
South Oxford, quarries, 89.
Sprague, John F., quarry, 75–76.
Spring, Wyman Flynn &, quarry, 23.
Springfield Flats, quarries, 89.
Standard bluestone co., 86.
Steamburgh, Abraham, quarry, 53.
Steifle, Charles, quarry, 33.
Sterrett, James, quarry, 19.
Steuben county, quarries, 97–100.
Stewart, O'Rourke &, quarry, 84.
Stewart & Dolan, quarry, 48.
Stice, Jake, quarry, 33.
Stone, extract from, 11.
Stone, Sylvester & Christopher Hawley, quarry, 47.
Stone Ridge, quarries, 43.
Stony Hollow, quarries, 17, 37.
Stoutenburgh & De Graff, quarry, 58.
Stratton & Davis, quarry, 58.
Stripping bluestone, 9–10.
Sullivan county, quarries in, 67–86.
Swartwout, G. W., quarry, 74.
Symmonds, Frank, quarry, 48.

Tappan, Rogers &, 60, 61, 62.
Teetzel & Burt, quarry, 53.
Terwilliger, McAuliffe &, quarry, 61.
Thayer, S., quarry, 92.
Tioga county, quarries, 95–96.
Tompkins county, quarries, 90–92.
Toole Bros., quarry, 40.
Tracy, William, quarry, 100.
Transportation of bluestone, 14–15.
Travis & Kingsbury, 75, 78, 79, 80, 86; quarry, 81.
Trumansburg, quarries, 90–91.
Tupper, Hobbs &, quarry, 75.
Turner Bros., quarry, 43.
Tyner, quarries, 89.

Ulster bluestone co., 18, 19, 20–21, 23, 25, 27, 30, 31, 32, 33, 34, 46, 47–48, 49, 50, 51, 56, 66.
Ulster county, elevation of beds, 4; bluestone, 5; bluestone quarries, 17–67; condition of bluestone industry in, 67.

Underwood, W. G., quarry, 71–72.
Unionville, quarries near, 22–23.

Valk & Hommell, quarry, 49.
Van Aken, James, quarry, 30.
Van Aken & Minko, quarry, 79.
Van Bramer Bros., quarry, 30–31.
Vandermark, Beatty &, quarry, 44.
Van Etten, Abraham, quarry, 60.
Van Etten, John, & Son, quarry, 55.
Van Hoevenburg & Nuger, quarry, 33.
Van Kleek, Egbert, quarry, 64–65.
Van Kleek & Dudrey, quarry, 63.
Van Steenburg & O'Connor, quarry, 22.
Vedder & Hackett, quarry, 27.
Vederkill, John, quarry, 32.
Veteran, quarries, 22–25, 26, 27; quarries near, 22.
Vly, quarries, 37, 42, 43.
Voight, A., quarry, 96.

Wagner, John, quarry, 103.
Wagner & Krum, quarry, 43.
Walker's Corners, quarries, 89.
Walley, F. D., quarry, 77.
Walton, quarries, 69–70.
Warner, Shellman &, quarry, 78.
Warsaw, quarries, 94–95.
Warsaw bluestone co., quarries, 94.
Wase & Burt, quarry, 51.
Wasson, M. T., quarry, 49–50.
Waste, McGhee &, quarry, 57.
Watkins, quarry, 93.
Watson, W. F., quarry, 37.
Waverly, quarries, 95–96.
West Hurley, quarries, 17, 37–40, 60.
West Saugerties, quarries, 17, 50–52; quarries near, 47.
Westfield, quarries, 103.
Weyman, Andrew, quarry, 76.
Wheeler, Roy, quarry, 72.
Whitcomb, H., quarry, 100.
White, Patrick, quarry, 82.
Whittaker, S. F. & Co., quarry, 74.
Whittaker & Manterstuck, quarries, 27.
Whittaker Bros., quarry, 57.
Wilbur, mills at, 66.
Willow postoffice, quarries near, 59.
Winchell, George, quarry, 43.
Winchell Bros., quarry, 40, 42.
Winne, George, quarry, 64.
Winne, Howard, quarry, 50.
Wolven, Ellis, quarry, 56.
Wolven, J. H., quarry, 48–49.
Wolven, Lawrence, quarry, 55.
Wolven, Lee & Frank Simmons, quarry, 47–48.
Wolven Bros., quarry, 47.
Wood, Comfort &, quarry, 84–85.
Woodruff, James, quarry, 92.
Woodstock, quarries, 17, 45, 56–57, 58, 60; quarry near, 53.
Woodward, F. F., quarry, 98–99.
Wyman Spring & Flynn, quarry, 23.
Wyoming county, quarries, 94–95.

Yates county, quarries, 92–93.
Yeager, Ethan, quarry, 52.
Yeager, Smith &, 17, 18, 22; quarry, 18–19.
Yerry, Charles, quarry, 57–58.
Yorke, Carle &, quarries, 29–30.
Young, Conrad, quarry, 32–33.
Young, George, quarry, 50–51.
Young, Huff &, quarry, 52.
Young, Schoonmaker &, quarries, 51.

Zimmer, Fred, quarry, 98.

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16–17	50 "	26–31	53 "	37–44	" v. 3
18–19	51 "	32–34	54 "	45–48	" v. 4

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UNIVERSITY OF THE STATE OF NEW YORK.

NEW YORK STATE MUSEUM.

FREDERICK J. H. MERRILL,
Director and State Geologist

MAP
OF THE
STATE OF NEW YORK

SHOWING THE LOCATION OF

BLUESTONE QUARRIES.

1902.

Lower Boundary of Hamilton Group.

The area south and west of this boundary is occupied by sandstones and shales of Hamilton, Portage, and Chemung age. In these formations are the beds quarried as bluestone.

Bluestone Quarries.

SCALE OF MILES

0 10 20 40 60

SCALE: 12 MILES TO 1 INCH

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CITY OF NEW YORK,
showing its Division into Boroughs.

SOUTHERN PART OF
NEW YORK.

Scale of Miles.

same scale as main Map.

NOTE: For details of New York City see local Map.

New York

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CONVENTIONS

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Ledges opened for some distance

Quarries not in operation

Roads and buildings

Private and secondary roads

Trails

Railroads

Street railroads

Tunnels

Bridges

Ferries

Fords

Dams

Locks

Triangulation stations

Bench marks

J E W E T T

C A I R O

C A T S K I L L

H U N T E R

W O O D S T O C K

K I N G S T O N

H U R L E Y

O L I V E

MAP OF
THE EASTERN CATSKILLS
SHOWING THE LOCATION OF
BLUESTONE QUARRIES

H. T. DICKINSON
1901

New York State Museum

The New York State Museum as at present organized is the outgrowth of the Natural History Survey of the State commenced in 1836. This was established at the expressed wish of the people to have some definite and positive knowledge of the mineral resources and of the vegetable and animal forms of the State. This wish was stated in memorials presented to the Legislature in 1834 by the Albany Institute and in 1835 by the American Institute of New York city and as a result of these and other influences the Legislature of 1835 passed a resolution requesting the secretary of state to report to that body a plan for "a complete geological survey of the State, which shall furnish a scientific and perfect account of its rocks, soils and materials and of their localities; a list of its mineralogical, botanical and zoological productions and provide for procuring and preserving specimens of the same; etc."

Pursuant to this request, Hon. John A. Dix, then secretary of state, presented to the Legislature of 1836, a report proposing a plan for a complete geologic, botanic and zoologic survey of the State. This report was adopted by the Legislature then in session and the governor was authorized to employ competent persons to carry out the plan which was at once put into effect.

The scientific staff of the Natural History Survey of 1836 consisted of John Torrey, botanist; James E. De Kay, zoologist; Lewis C. Beck, mineralogist; W. W. Mather, Ebenezer Emmons, Lardner Vanuxem and Timothy A. Conrad geologists. In 1837 Professor Conrad was made paleontologist and James Hall, who had been an assistant to Professor Emmons, was appointed geologist to succeed Professor Vanuxem, who took Professor Conrad's place.

The heads of the several departments reported annually to the governor the results of their investigations, and these constituted the annual octavo reports which were published from 1837 to 1841. The final reports were published in quarto form, beginning at the close of the field work in 1841, and 3000 sets have been distributed, comprising four volumes of geology, one of mineralogy, two of botany, five of zoology, five of agriculture and eight of paleontology.

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